URSAN POMPA LTD. STI.

Original – Operating Instructions
3400.88/3 – 10

UPA 150C

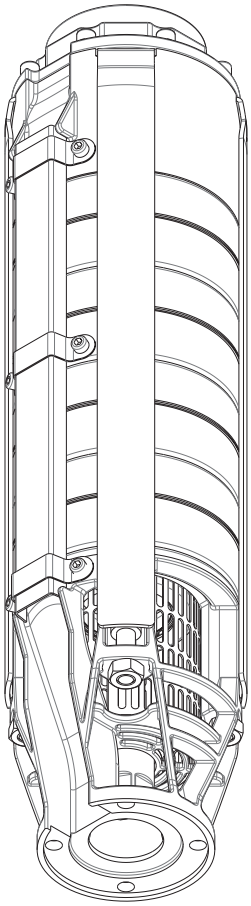
Caution:

These operating instructions contain fundamental information and precautionary notes. Please read the manual thoroughly prior to installation of unit, connection to the power supply and commissioning.
It is imperative to comply with all other operating instructions referring to components of this unit.

Submersible Motor Pump

UPA 150C

Submersible Borehole Pumps



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1 Manual introduction

1.1 Preface

The manual contains important information for reliable, proper and efficient operation. Compliance with the operating instructions is of vital importance to ensure reliability and a long service life of the pump and to avoid any risks.
Chapters 1 and 2 contain information about this manual and safety in general. The following chapters provide information about normal use, installation, maintenance and repairs of the pump. The annexes contain the technical data, the parts drawings and the declaration(s) of conformity.

- Make yourself familiar with the content.
- Accurately follow the directions and instructions.
- Never change the sequence of the operations to be carried out.
- Keep this manual or a copy of it together with the logbook in fixed place near the pump, which can be accessed by all personnel.

1.2 Icons and symbols

In this manual and in all accompanying documentation the following icons and symbols are used.

WARNING
Danger of electric tension. Safety sign according to IEC 417 - 5036

WARNING
Operations or procedures, if carried out without caution, may cause personal injury or damage to the pump. General hazard sign according to ISO 7000-0434

ATTENTION
Is used to introduce safety instructions whose non-observance may lead to damage to the pump and its functions.

ENVIRONMENTAL INSTRUCTION
Remarks with respect to the environment.

2 Identification, service and technical support

2.1 Obtaining data and information

The name plate indicates the type series / size, main operating data and identification number. Please quote this information (first two lines*) in all queries, repeat orders and particularly when ordering spare parts. If you need any additional information or instructions exceeding the scope of this manual or in case of damage please contact KSB nearest customer service centre.

The name plate on the pump specifies:

- Serial number;
- Model / size;
- Q_{min} / Q_{max} for 50 Hz operation;
- H_{max} / H_{min} for 50 Hz operation;
- Q_{min} / Q_{max} for 60 Hz operation;
- H_{max} / H_{min} for 60 Hz operation.

When the pump is already fitted with a motor, the name plate on the pump also specifies:

- Model / size;
- Frequency;
- P_{req};
- Q_{opt};
- H_{opt}.

Before installing the UPA 150C, we recommend to copy the name plate data into the operating manual.

Please consult the seperate booklet “Service-addresses” for service and technical support.

2.2 Supplementary documentation

Apart from this manual, the documentation given below is also available:

Document	Date/version	Code
General terms of delivery	June 2002	0074.01/22, 0071a/11
Service-addresses	28/06/2005	0092.01/31
See also www.ksb.com		

3 Warranty

3.1 Terms of warranty

The warranty period is settled by terms of your contract or at least by the general terms and conditions of sales.

ATTENTION
Modifications or alterations of the pump supplied are only permitted after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts can invalidate any liability of the manufacturer for consequential damage.

ATTENTION
The warranty relating to the operating reliability and safety of the pump supplied is only valid if the pump is used in accordance with its designated use as described in the following sections of this manual. The limits stated in the data sheet must not be exceeded under any circumstances.

The warranty becomes invalid if one or more of the points below occur.

- The buyer makes modifications himself.
- The buyer carries out repairs himself or has these carried out by a third party.
- The pump has been handled or maintained improperly.
- The pump has non original KSB spare parts fitted.

KSB remedies defects under warranty if the points below are observed.

- Defects are caused by flaws in the design, the materials or the production.
- The defect has been reported within the warranty period.

Other terms of warranty have been included in the general terms of delivery, which are available upon request.

4 Safety and environment

4.1 General

This KSB pump has been developed in accordance with state-of-the-art technology; it is manufactured with utmost care and subject to continuous quality control.
KSB does not accept any liability for damage and injury caused by not observing the directions and instructions in this manual. This also applies in cases of carelessness during the installation procedure, use and maintenance of the pump.
Non-compliance with safety instructions can jeopardize the safety of personnel, the environment and the pump itself. Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages.
In particular, non-compliance can, for example, result in:

- failure of important pump/system functions,
- failure of prescribed maintenance and servicing practices,
- injury to persons by electrical, mechanical and chemical effects,
- hazard of the environment due to leakage of hazardous substances,
- explosions.

Depending on specific activities, extra safety measures may be required. Contact KSB if during use a potential danger arises.

ATTENTION
The owner of the pump is responsible for compliance with the local safety regulations and internal company guidelines.

ATTENTION
Not only must the general safety instructions laid down in this chapter on "Safety" be complied with, but also the safety instructions outlined under specific headings

4.2 Users

All personnel involved in the operation, maintenance, inspection and installation of the pump must be fully qualified to carry out the work involved.
Personnel responsibilities, competence and supervision must be clearly defined by the operator. If the personnel in question is not already in possession of the required know-how, appropriate training and instruction must be provided. If required, the operator may commission the manufacturer / supplier to take care of such training. In addition, the operator is responsible for ensuring that the contents of the operating instructions are fully understood by the responsible personnel.

4.3 Safety provisions

The pump has been designed with the greatest possible care. Original parts and accessories meet the safety regulations. Modifications in the construction or the use of non-original parts may lead to a safety risk.

ATTENTION
Make sure that the pump operates within its working range. Only then the pump performance is guaranteed.

4.3.1 Labels on the pump

The icons, warnings and instructions applied to the pump are part of the safety provisions. The labels may not be removed or covered. Labels must remain legible during the entire life of the pump. Replace immediately damaged labels.

4.4 Safety precautions

4.4.1 During normal use

- Contact the local electricity company for questions about the power supply.
- Shield parts that can become hot in such a way, that direct contact is impossible.
- Always place undeformed coupling protection plates to protect the coupling, before putting the pump into use. Make sure that the coupling protection plates are never in contact with the running coupling.
- Always close the switch box.

4.4.2 During installation, maintenance and repair

Only authorised personnel may install, maintain and inspect the pump and repair electrical components. Observe the local safety regulations.

WARNING
Always disconnect the energy supply to the pump first, before installation, maintenance and repairs. Secure this disconnection.

WARNING
Surface of the pump can be hot, after continuous operation.

WARNING
Make sure that no one can be near rotating components when starting the pump.

WARNING
Handle a pump with dangerous liquids with the utmost care. Avoid danger for persons or the environment when repairing leakages, draining liquids and venting. It is strongly recommended to place a relief barge under the pump.

WARNING
Immediately following completion of the work, all safety-relevant and protective devices must be re-installed and / or re-activated.

WARNING
Please observe all instructions set out in the chapter on "Commissioning/ Start-up" before returning the pump to service.

4.5 Environmental aspects

4.5.1 General

The pumps of KSB are designed to function in an environmentally friendly way during their entire life. Therefore always use biodegradable lubricants for maintenance.

ENVIRONMENTAL INSTRUCTION
Always act according to the laws, by-laws regulations and instructions with respect to health, safety and the environment.

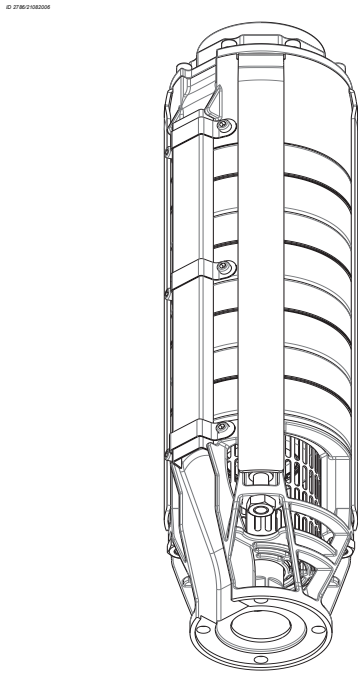
4.5.2 Dismantling

Dismantle the pump and dispose of it in an environmentally friendly way. The owner is responsible for this.

ENVIRONMENTAL INSTRUCTION
Ask at the local government about the re-use or the environmentally friendly processing of discarded materials.

5 Pump introduction

5.1 General



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Borehole pump UPA 150C

The single- or multistage borehole pumps **UPA 150C** are produced by KSB, Alphen aan den Rijn, Holland.

5.2 Description of the product

The **UPA 150C** borehole pumps are designed for well diameters of 150 mm (6 inches) and larger. They are particularly suitable for vertical installation in narrow deep wells

The **UPA 150C** consist of a single- or multistage, single-entry centrifugal pump and a rigidly coupled electric motor (when applicable, fitted to the pump afterwards). The pump is initialy designed for vertical, stationary use in water. With the restrictions as described in this documentation it can also be installed horizontally.

The suction casing, located between pump and motor, is equipped with a suction strainer to protect the pump from coarse particles in the fluid. The **UPA 150C** borehole pumps are equipped with a check valve, and are available with internal thread or flanged end.

5.3 Intended use

The UPA 150C material execution C1 are suitable for applications with clean, thin, non-aggressive liquids without solid parti-cles or fibres. The UPA 150C material execution C2 versions are made of a higher grade of stainless steel and are available for applications involving more aggressive liquids.

The maximum permissible sand content in the fluid is 50 g/m^3. A larger sand content will reduce the life of the pump and increase the risk of blocking.

The transport of liquids with a different viscosity or density than water is possible as well. For this a motor with an adjusted power is used. Ask KSB or your distributor for advice.

Any other or further use of the **UPA 150C** is not in conformity with its intended use. KSB does not accept any liability for any damage or injury that results from this. The **UPA 150C** is produced in accordance with the current standards and guidelines. Use the **UPA 150C** only in a perfect technical state, conform with the intended use described below.

The *Intended use* as laid down in EN 12100-1 is the use for which the technical product is intended according to the specifications of the manufacturer. The use of the product has been described in the sales brochure and in the user manual. Always observe the instructions given in the user manual. When in doubt the product must be used as becomes evident from its construction, version and function

5.4 Working range

Working range of the pumps in this series can be summarised as follows:

Table 1: Specifications of the working range

Pump type:	UPA 150C material execution C1	UPA 150C material execution C2
Main material	Stainless steel AISI 304	High grade stainless steel AISI 316
Liquid temperature [°C]	0 to 60[1]	
Liquid temperature [°F]	32 to 140[1]	
Q_{max} 50/60 Hz [m^3/h]	79 / 93	
Q_{max} 50/60 Hz [US.gpm]	348 / 410	
H_{max} 50/60 Hz [m]	573 / 730	
H_{max} 50/60 Hz [ft]	1880 / 2400	
Maximum working pressure 50 Hz [kPa]/[bar]/[psi]	5730 / 57,3 / 831	
Maximum working pressure 60Hz [kPa]/[bar]/[psi]	7300 / 73,0 / 1060	
Minimum supply pressure	Not cavitating	
Viscosity liquid [cSt]	1	
	A higher viscosity may require more motor power.	
Density liquid [kg/dm³] / [lbs/inch^3]	1,0 / 0.036	
	A higher density may require more motor power.	
Number of starts	Related to the motor	
Minimum frequency [Hz]	10	
Maximum frequency [Hz]	60	
Max. power [kW] / [HP]	37 / 50	

1. Maximum liquid temperature for the pump only. For maximum allowable liquid temperature of the motor, please consult the technical documentation of the motor concerned.

Table 2: Specific applications

Pump type:	Application area:
UPA 150C material execution C1	Domestic and general water supply, irrigation systems, groundwater lowering, pressure boosting, fountains, air-conditioning systems, cooling water cycles, fire protection, industrial applications.
UPA 150C material execution C2	Raw water supply, irrigation systems, groundwater lowering, pressure boosting, air-conditioning systems, cooling water cycles, fire protection, industrial applications.

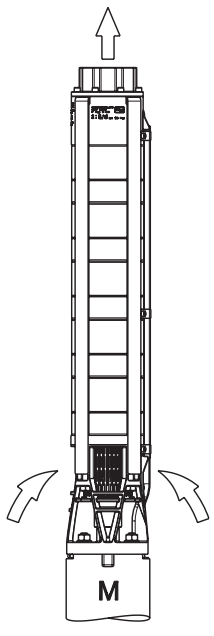
5.5 Model key

Table 3: Model key UPA 150C

	UPA	150	C	-	16	/	9
Type series							
Minimum well diameter (mm)							
Design status							
Capacity (m^3/h)							
Number of stages							

5.6 Functional principle of the UPA 150C

The liquid is sucked in through the pump inlet on the suction side under minimum pressure. The pump increases the pressure. The liquid leaves the pump through the pump outlet on the delivery side under increased pressure.



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Functional principle of the UPA 150C

5.7 Sound pressure levels

5.7.1 Sound pressure level of pumps

The sound pressure level has been measured in accordance with the rules laid down in the EC machinery directive 98/37/EC, and applies to pumps submerged in water, without external regulating valve.

Pump type	dB(A)
UPA 150C 16	<70
UPA 150C 30	<70
UPA 150C 48	<70
UPA 150C 60	<70

5.7.2 Sound pressure level of motors

The sound pressure level of the motor depends on the motor used in combination with the UPA 150C pump. Consult the documentation of the motor concerned for the exact specifications.

6 Transport

6.1 Transport

WARNING
Lift the pump, if necessary using a hoist and suitable slings. Attach the slings to the hoisting eyes on the packaging, where present.

WARNING
The pump must be hoisted according to the current hoist guidelines. Only qualified personnel are allowed to hoist the pump.

WARNING
Always make sure that the pump cannot tip over!

WARNING
Always protect electric cabling from mechanical damage!

During unpacking and prior to installation, care must be taken when handling the pump to ensure that misalignment does not occur due to bending.

Transport of a borehole pump requires proper preparation and handling. Only approved transport equipment and lifting gear shall be used. The pump is supplied in packaging which largely prevents sagging or other damage during transport and storage. Prior to and during unpacking, check whether the packaging has been damaged.

1. Transport the pump in the position as indicated on the pallet or packaging.
2. Make sure the pump is stable.
3. Observe the instructions on the packaging (if present).

When using a fork-lift truck to transport the pump unit in horizontal position, make sure to take into account the possibly very unequal weight distribution between pump and motor. Normally, the centre of gravity will be in the motor area. When transporting the pump unit in horizontal position with a crane, sling points shall be chosen to prevent excessive bending stresses on the pump unit, e.g. in the middle of the motor and at the upper end of the pump unit.

The use of chains or steel wires is not recommended, as there is a risk of the chains / wires slipping, resulting in personal injury and / or damage to property. Always make sure the pump is properly secured when standing vertically. Otherwise, the pump may tip over and cause personal injury or damage to property.

When the pump part and motor are supplied as separate units, fit the motor to the pump as described in *** 'Fitting the motor to the pump (vertical installation)' on page 18 ***

6.2 Storage

The borehole pumps must be stored as follows:

- Vertically.
- Dry.
- Protected against direct sunlight and heat.
- Protected against dirt and dust.
- Protected against freezing.

If the pump unit cannot be stored in vertical position, it must be stored in such a way that sagging is prevented. The cable must be supported at the point where it comes out of the cable guard and protected against kinking. The cable ends must be protected against the ingress of moisture and dirt. In cases where motors have to be dismantled into components, the individual components shall be dried with warm air and preserved with anti-freeze.

Storage	
$t_{ambient}$ [°C]	-20/60
Max. rel. humidity [%]	80% at 20°C

7 Installation conditions

7.1 Installation conditions

WARNING
Minimum submersion > 0.5 m! A higher submergence may be required.

The borehole pumps are suitable for installation in deep wells, tanks, reservoirs or mine shafts. As they are only operated when fully submerged, they have no special requirements on rooms or buildings.

The borehole pumps must be installed in such a way that they neither sit on the base of the well nor touch the well or tank walls. Fit centering devices on the riser pipe or diaphragm housing of the motor, if necessary. The centering devices must not be fitted in the motor / pump casing area, however.

If several pump units are installed side by side, mutual interference must be prevented by ensuring a certain minimum installation distance (see layout drawing supplied in such cases).

ATTENTION
Vortex formation, which would result in air intake or dry-running of the top pump bearing, must be prevented. The pump must never be allowed to run dry.

Dry-running may be caused by low well yields or other marked water level fluctuations. In such cases, dry-running protection must absolutely be provided.

7.2 Liquid temperatures/cooling

For the maximum liquid temperature and the minimum liquid velocity over the motor please consult the documentation of the motor concerned.
It is recommended to install the motor above the well screen in order to achieve proper motor cooling.

ATTENTION
In cases where the stated liquid velocity cannot be achieved, a flow sleeve must be installed.

If there is a risk of sediment build-up, such as sand, around the motor, a flow sleeve should be used in order to ensure proper cooling of the motor.

Out of consideration for the rubber parts in pump and motor, the liquid temperature must not exceed 30°C. The pump itself can also operate at liquid temperatures above 30°C. Please contact your supplier for the exact possibilities, or consult the technical documentation of the motor used in combination with the UPA 150C.

ATTENTION
If the pump is used for pumping hot liquids, precautions should be taken to ensure that persons cannot come into contact with the pump and the installation.

7.3 Liquid quality

The borehole pumps are suitable for operation in clean or slightly contaminated water of the following quality:

7.3.1 Sand content

Maximum sand content: up to 50 g/m^3. Higher sand contents may be permitted for more wear-resistant pump variants.

7.3.2 Aggressiveness

There are defined material variants available for the following water qualities:

- UPA 150C material execution C1 for neutral or slightly aggressive water.
- UPA 150C material execution C2 for more aggressive liquids.

7.3.3 Ochre content

If the pump is operated in water with a high ochre content, the suction strainer may be clogged with ochre so that the pump must be prematurely removed from the well. In the case of otherwise clean water and if the pump is installed well clear of the filter zone, we recommend to remove the suction strainer before the pump is installed for the first time. Also, ochre deposits may form on the motor (in the stator area), which will affect the motor cooling. In such cases, a temperature monitoring device is absolutely required.

7.4 Vertical installation

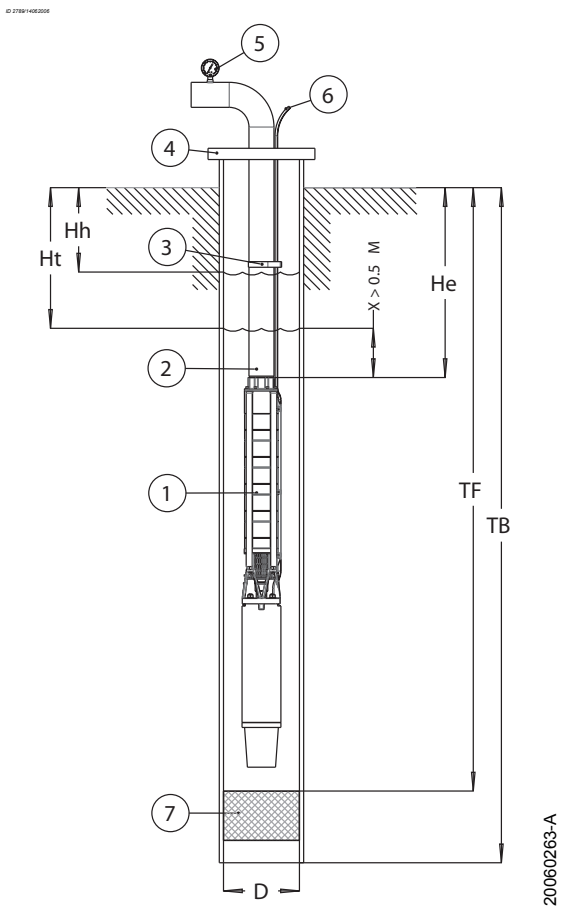
WARNING

The construction of the well head must meet the relevant regulations of the competent authorities! The pump unit must never be installed with its suction strainer exactly at the level of the well screen / filter!

The maximum diameter of the UPA 150C pump is always 6” (150mm). It is recommended to check the borehole with an inside calliper to ensure unobstructed passage.

Check narrow boreholes for dimensional accuracy over their entire length, e.g. by inserting a pipe of the length and biggest outside diameter of the pump or motor. Sharp bends or bottlenecks can make installation difficult or even impossible.

The pump unit is supported on the well head by supporting clamps (low-weight units and low submergence) or a supporting flange.



Vertical installation (deep well, pump sump, etc.)

1 Borehole pump UPA 150C
2 Riser pipe
3 Cable tie
4 Supporting flange / well head
5 Pressure gauge
6 Power supply cable
7 Well screen / filter

D =Inside well diameter
TB =Well depth
TF =Well screen / filter depth
He =Installation depth
Hh =Static water level
Ht =Dynamic water level (pumping water level)

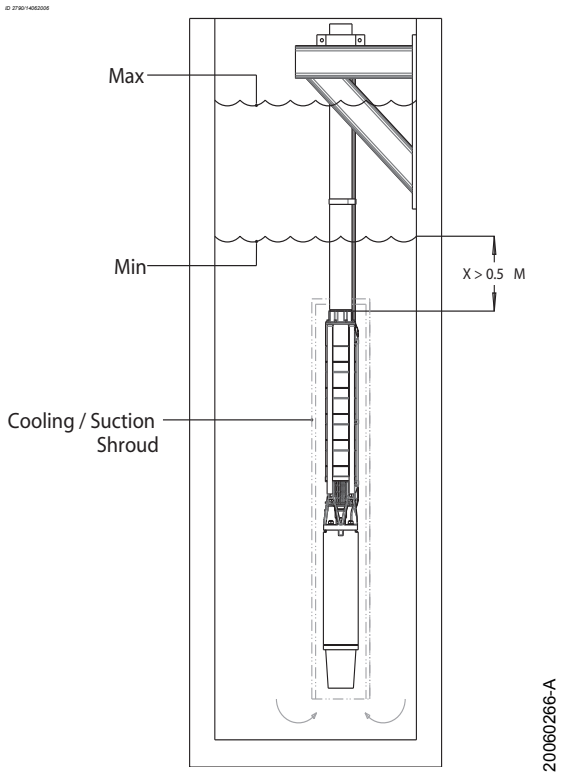
The suspension arrangement of the pump unit must be designed and dimensioned so that all static and dynamic forces can be absorbed and that the riser

pipe cannot slip downwards. The supporting clamps or flanges must be fastened at the well head so that they cannot shift or lift off the well head.

System-induced vibrations must not be transmitted to the pump. The system must be designed in such a way that vibrations are not amplified. Abrupt pressure equalization processes (pressure surges), in particular, present a hazard for the pump. Suitable precautions must be taken (e.g. expansion joints, air vessels).

The pump unit must never be installed with its suction strainer exactly at the level of the well screen / filter where excessive flow entails the risk of large amounts of sand clogging the well screen / filter and causing excessive wear in the pump.

ATTENTION
Pump units installed in a pump sump must generally be equipped with a cooling or suction shroud

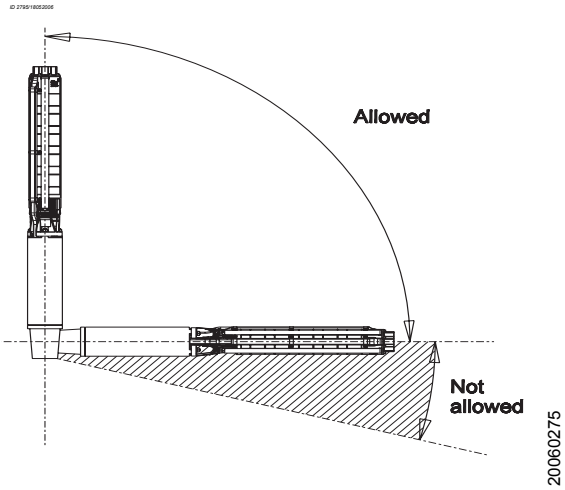


Installation in a pump sump

7.5 Horizontal installation

Depending on motor type and number of stages, the pump can also be installed in horizontal position. For detailed information about this possibility for the motor, consult the documentation of the motor concerned or contact the motor supplier/distributor.

ATTENTION
If the pump is installed in a horizontal position, the discharge port should never be positioned below the horizontal plane.

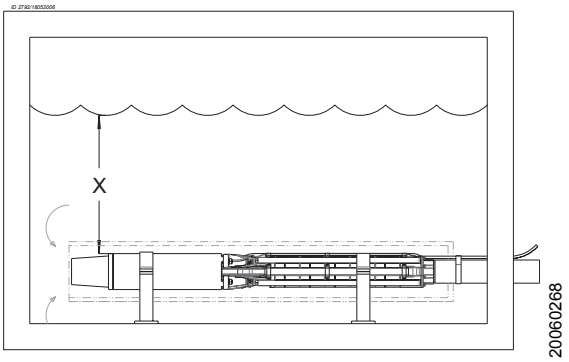


The instructions given in vertical installation shall also apply by analogy to horizontal installation, when the pump unit is fitted on mounts (pedestals / supporting frame / pump shroud).

WARNING
If the pump unit is to be installed in an accessible position, the coupling must be suitably isolated to prevent the possibility of human touch.

ATTENTION
The ground / foundation must be level and of sufficient load-bearing capacity to accept the weight of the pump unit with supports.

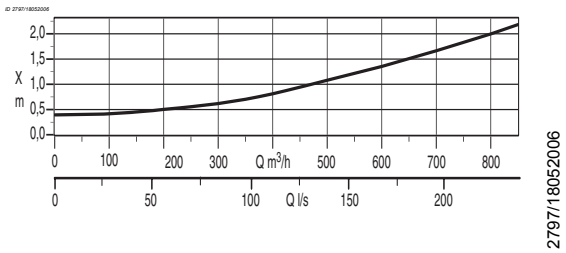
ATTENTION
Air intake from an inlet arranged above the water level is not permitted.



Horizontal installation (Tanks, mine shafts etc.)

7.6 Minimum submersion X

Minimum submersion refers to the upper edge of the suction strainer for horizontal installation, and to the upper edge of the check valve for vertical installation. Dimension X in m depends on the flow rate Q of the pump at duty point.



Minimum submersion X

8 Installation at site

8.1 Installation tools and equipment

WARNING
Lift the pump, using a hoist and suitable slings. Attach the slings to hoisting eyes when present.

WARNING
The pump must be hoisted according to the current hoist guidelines. Only qualified personnel are allowed to hoist the pump.

WARNING
Always make sure that the borehole pump cannot tip over!

WARNING
Tools, equipment or accessories with sharp edges (e.g. sharp-edged pipe sockets) shall not be used during installation.

WARNING
During the entire installation procedure the electric cabling must be adequately protected to prevent mechanical damage.

Installation and removal of borehole pumps requires suitable lifting gear, for example a tripod, mobile crane, etc. Its load-carrying capacity must be greater than the weight of pump / riser pipe with water fill (see table below), power supply cable, holders, etc. Use suitable lifting tackle. The use of chains or steel wires is not recommended, as there is a risk of the chains / wires slipping, resulting in personal injury and / or damage to property.

Weight of water fill per 1m of riser pipe							
DN (mm)	50	80	100	125	150	200	250
R (inch)	2	3	4	5	6	8	10
m (kg)	2	5	8	12	18	32	49

Further equipment / accessories may be needed, depending on the installation type.

8.2 Motor fill

WARNING
The motor fill must always be checked prior to installation.

ATTENTION
For specific instructions about filling up submersible motors, carefully follow the instructions given in the documentation of the motor concerned!

WARNING
Wear safety glasses and protective gloves when handling (topping up, checking and draining) the motor fill. The local health and safety regulations shall be observed. The mixture must be disposed of in compliance with local applicable regulations.

The procedure for checking the filling level and topping up the motor fill differs, depending on the motor concerned. Please refer to the instructions given in the documentation of the motortype used with the UPA 150C.

When filling the motors or topping up the motor fill, use water in compliance with the European drinking water directive (normal clean drinking water) or a drinking water / anti-freeze mixture , depending on motor type, use, and risk of freezing.

8.3 Check valve

ATTENTION
Borehole pumps are not designed for uncontrolled backflow of the fluid through the pump. Suitable precautions must be taken to prevent reverse rotation of the pump.

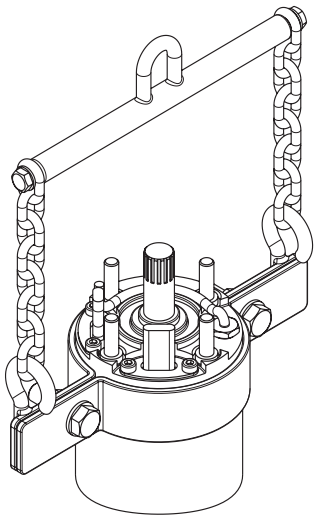
The borehole pumps generally feature an integrated check valve. Where pump units without check valve are installed or in systems where check valves have not been installed in the appropriate places, emptying of the riser pipe upon pump shut-down may result in backflow of the fluid through the pump. The pump unit may reach inadmissible rotational speeds which will eventually damage the pump. If the specific system configuration requires emptying of the riser pipe, suitable measures shall be taken to reduce the amount of backflow so that the pump rotor does not rotate.

8.4 Fitting the motor to the pump (vertical installation)

WARNING
Before starting work on the pump, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

When the UPA 150C borehole pumps are supplied without motor, fit the motor to the pump as follows:

1. Use pipe clamps when handling the motor.
2. Place the motor in vertical position at the well head.



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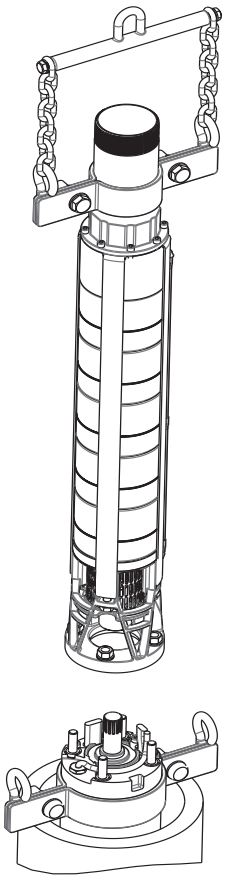
3. Lift the pump part by means of pipe clamps fitted to the extention pipe



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4. Place the pump part on top of the motor.

5. Fit and tighten the nuts, see the following table.

Make sure that the coupling between the pump and motor engages properly. When fitting the motor to the pump part, the nuts must be tightened diagonally to the torques as stated in the following table:

Pump/motor stud diameter	Torque [Nm]
M8	18
M12	70
M16	150
M20	280

ATTENTION
Make sure that the pump chambers are aligned when assembly has been completed.

8.5 Changing the pipe connection / removal of the check valve

The UPA 150C is fitted with an unique interchangeable adapter which makes it possible to change the pipe connection whenever this is necessary. (e.g. When the pump is (re)installed in a well with a flanged riser pipe in stead of a threaded riser pipe.) Also, because of the interchangeable adapter, the check valve is easily accessible or (when required), removable.

ATTENTION
For changing the pipe connection / removal of the check valve the use of a tyre lever is not required!

8.5.1 Changing the pipe connection

When the pipe connection needs to be changed, proceed as follows:

1 Loosen and remove the hexagon socket head screws (914.01) at the discharge side of the pump.
2 Take of the (threaded or flanged) adapter (145).
3 Fit the required adapter to the pump.
4 Place the removed hexagon socket head screws (914.01), and tighten them crosswise.

8.5.2 Removal of the check valve

When the check valve has to be accessed or removed, proceed as follows:

1 Loosen and remove the hexagon socket head screws (914.01) at the discharge side of the pump.
2 Take of the (threaded or flanged) adapter (145).
3 Take out the valve spring (756) and valve plate (759).
4 (In case of cleaning or replacement), put back the valve plate (759) and valve spring (756).
5 Put back the (threaded or flanged) adapter (145).
6 Place the removed hexagon socket head screws (914.01), and tighten them crosswise.

8.6 Electrical connections

ATTENTION
For specific instructions about connecting the submersible motors, carefully follow the instructions given in the documentation of the motor concerned!

WARNING
Before starting work on the pump, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

WARNING
The electrical connection should be carried out by an authorized electrician in accordance with local regulations.

WARNING
The pump unit must be earthed and must be connected to an external mains switch.

8.7 Vertical installation at site

WARNING
During installation work, suitable precautions shall be taken to protect anyone from falling into the open well / reservoir / tank. Suitably fence off the work area.

WARNING
A pair of supporting clamps must always be attached to the riser pipe, to prevent the pump unit from dropping!

ATTENTION
The first pipe section must not be longer than 2 m!

In order to prevent inadmissible sagging of the pump unit during lifting, the first pipe section must not be longer than 2 m. During the entire installation procedure a pair of supporting clamps shall always remain affixed to the riser pipe, to prevent the pump unit from dropping. In vertical installation, the pump unit is suspended in the well head. Threaded riser pipes are best supported with a socket and flanged riser pipes with a flange on the load-bearing element (e.g. supporting clamp) in the well head, unless some other arrangement in the well head prevents the riser pipe from slipping through.

8.7.1 Installation with threaded riser pipe

1 Attach a pair of supporting clamps to the first pipe section (max. 2 m long) just below the upper socket and screw this pipe into the pump unit using a thread-locking agent. Secure with the two locking screws supplied, if applicable. For this purpose, drill a shallow hole into the threaded end of the pipe section, taking care not to drill through the threaded end. Insert the locking screws with thread-locking compound in such a way that their tips rest lightly but do not press on the threaded pipe end! Allow time for the compound to cure. The connection is now sufficiently secured against loosening.
2 Use cable ties to attach the power supply cables as well as the control and measuring cables, if any, to the riser pipe approx. 0.5 m above the socket.
3 Lift the pump unit by the first pair of supporting clamps with the lifting gear (e.g. tripod or mobile crane) and lower it into the well until the pair of supporting clamps sits on the upper flange of the well or well head.
4 Then assemble the second pipe section, using a second pair of supporting clamps.
5 Remove the supporting clamps from the first pipe section and lower the pump unit down the well until the second pair of supporting clamps sits on the the upper edge of the well or well head.
6 Repeat these steps for every pipe section, lowering the unit into the well until the installation depth is reached.

8.7.2 Installation with flanged riser pipe

ATTENTION
Only use pipes with recesses in the flanges!

Use pipes with flange recesses only (2 recesses as standard, offset by 90^{o}). In these recesses, the power cable will be protected against mechanical damage during pump installation and removal. These units are installed using a mounting plate in addition to supporting clamps. Installation procedure:

1 Fasten the first pipe section (max. length: 2 m) to the pump. Assemble the mounting plate to this pipe section, as well as the first pair of supporting clamps immediately below the upper flange.
2 Use cable ties to attach the power supply cables as well as the control and measuring cables, if any, to the riser pipe approx. 0.5 m above the flange.
3 Place two sturdy beams across the well opening.
4 Attach the pump to the crane hook (e.g. mobile crane) by the mounting plate and lower it into the well until the first pair of supporting clamps rests

on the beams. The supporting clamps will hold the pump unit so that the mounting plate can be removed and the second riser pipe can be fitted.

5 Fasten the mounting plate and the second pair of supporting clamps to the second riser pipe. Attach the pump unit to the crane again, remove the first pair of supporting clamps and lower the pump until the second pair of supporting clamps sits on the beams.

6 Repeat these steps for every pipe section, lowering the pump unit into the well until installation depth is reached.

8.7.3 Fixing the electric cable to the riser pipe

WARNING
Tighten the ties firmly to ensure that the electric cable cannot slip downwards.

The cables shall be fixed to the riser pipe by a cable tie each on both sides of the riser pipe flange or socket. 1 tie shall be used per electric cable and every 3 metres of riser pipe. Tighten the ties firmly to ensure that the electric cable cannot slip downwards by its own weight! There is danger of the cables being subjected to excessive tensile stress. The type of cable tie used depends on the cable cross-section (or cable weight).

8.8 Horizontal installation at site

ATTENTION
Check whether horizontal installation is permissible first!

ATTENTION
Non-flooded pump units must always be protected against direct sunlight! If there is a danger of freezing, check that the motor fill is suitable for the below-zero temperatures anticipated.

Horizontal non-flooded pump units must always be protected against direct sunlight by suitable covers (e.g. when fountains are shut down for cleaning work), to prevent overheating of the motor. Prolonged shut-down periods of non-flooded borehole pumps can reduce the fluid level in the motor (evaporation, etc.). Before flooding the pump units, the water fill of the motors must always be checked and topped up if required.

If there is a danger of freezing, check that the motor fill is suitable for the below-zero temperatures anticipated. If necessary, the pump unit must be removed or the motor must be filled with a suitable water-antifreeze mixture.

ATTENTION
For pump units with suction or pressure shrouds, the additional notes in the enclosed installation instructions must be observed.

ATTENTION
Before placing the pump unit in horizontal position, check the motor fill according to the instructions given in the documentation of the motor concerned.

ATTENTION
For exact procedures for horizontal installation of the pump and motor, please follow the instructions in the documentation of the motor concerned and, if applicable, in the enclosed installation instructions provided with the horizontal installation kit.

8.9 Re-installing the pump unit

Before re-installing the pump unit (e.g. after on-site repair) check the free radial and axial movement of the rotor. Depending on the size and weight of the pump unit, this must be done separately for the motor and the pump. Also, rotor position (pump and motor) and axial clearance have to be checked. For large pump units, auxiliary equipment will be required. This work should be performed by trained personnel only.

If the rotor cannot be turned or lifted, we recommend that you contact our nearest service centre.

In addition, the winding insulation resistance must be checked, unless this has already been done during winding repair or when connecting the extension cable. The winding insulation resistance should be measured by a trained electrician only.

9 Commisioning / start-up / shutdown

9.1 Commissioning / Start-up

WARNING
The pump unit shall only be switched on when the motor is filled and the pump is fully submerged or flooded!

WARNING
As a rule, borehole pumps shall be started up against a closed gate valve!

Due to the water-lubricated plain bearings in the pump and motor, the pump units must only be switched on with filled motor and when fully submerged or flooded. Start-up outside the water, even for short periods, is not permitted.

To prevent pressure surges in the borehole pumps, as a rule, must be started up against a closed gate valve as follows:

- Close the discharge-side gate valve.
- Switch on the pump unit and open the gate valve slowly until the pump head and current intensity as shown on the name plate are reached.

ATTENTION
If the pump is started up against an empty riser pipe, the gate valve shall not be closed completely, to allow air to escape through the remaining gap into the riser pipe. It is not necessary to delay the start-up of a gate valve with electric actuator, as the run-up time of the pump is shorter than the dead time of the gate valve.

If there are impurities in the water, the valve should be opened gradually as the water becomes clearer. The pump should not be stopped until the water is completely clean, otherwise the pump parts and the non-return valve may be blocked.

As the valve is being opened, the draw-down of the water level should be checked to ensure that the pump always remains submerged. The dynamic water level should always be above the suction interconnector of the pump.

If the pump can pump more than yielded by the well, it is recommended to fit a control unit or some other type of dry-running protection. If no water level electrodes or level switches are installed, the water level may be drawn down to the suction interconnector of the pump and the pump will then draw in air. Long time operation with water containing air may damage the pump and cause insufficient cooling of the motor.

9.1.1 Checking of direction of rotation

WARNING
Do not run the pump unit for more than 5 minutes in either direction when checking the direction of rotation!

WARNING
Make sure that the suction strainer has been completely submerged in the liquid before starting the pump.

ATTENTION
Seen from the connection side of the motor the correct direction of rotation should always be counterclockwise!

When the pump unit has been connected to the electricity supply, determine the correct direction of rotation as follows:

1 Start the pump and check the quantity of water and head developed.
2 Stop the pump and interchange two of the phase connections.
3 Start the pump and check the quantity of water and head developed.
4 Stop the pump.
5 Compare the results taken. The connection with the larger quantity of water and the higher head is the correct connection.

To prevent damage to the motor, make sure that the pump unit does not run in the wrong direction of rotation against the closed gate valve for more than 5 minutes.

9.2 Commissioning / Start-up (sand content)

Pump units started up in new boreholes for the first time shall only be operated for approx. 10 minutes with the gate valve only slightly open, also to prevent damage to the well. The water pumped must be checked for any sand content first. If the water contains relatively high amounts of sand, there is a risk for both the pump unit and the well. The pump unit must then be operated with the gate valve only partially open (40% of well yield at the most) until the sand content has dropped. Only then shall the gate valve be slowly opened further.

If the sand content does not fall below 50 g/m^3, please contact the well building company or your nearest KSB service centre.

9.3 Minimum flow rate

To ensure the necessary cooling of the motor, the pump unit should never be set so low that the cooling requirements specified in the technical documentation of the motor concerned cannot be met.

9.3.1 Pump operation with partially closed gate valve

If the pump unit is continuously operated against a partially closed gate valve, the flow rate must not fall below Q_{min} (see name plate).

9.3.2 Pump operation with closed gate valve

Pump operation with closed gate valve The pump units shall not be operated against a closed gate valve for more than 5 minutes (max.), as the water inside the pump will heat up very quickly and the heat produced will be transferred to the motor, where it may damage the motor winding. Also, bearing damage cannot be ruled out.

9.4 Operating limits

To ensure operational reliability and prevent cavitation, borehole pumps in continuous operation shall only be operated up to the maximum flow rate (Q_{max}) indicated on the name plate. In addition, the maximum permissible power or current intensity must not be exceeded (see name plate). If necessary, power or current intensity must be reduced to the permissible limits by throttling the gate valve accordingly.

9.5 Shutdown

WARNING
Only switch off the pump unit without preparations (emergency stop) if the system has been designed to withstand the resulting pressure surges!

As a rule, the pump shall be switched off with the gate valve closed. Proceed as follows:

- Close the discharge-side gate valve slowly.
- Switch off the motor immediately after closing the gate valve.

10 Operation

10.1 Operation

The pump is controlled externally and therefore does not need any operation guidance.

11 Servicing and maintenance

11.1 Servicing / Inspection

WARNING
Observe the general safety precautions for installation, maintenance and repair.

The borehole pumps are generally maintenance-free. In order to pin-point indications of potential damage at an early stage, regular checks are required. Possible indications of potential damage:

- Temperature rise in the fluid pumped;
- Increased sand content of the fluid pumped;
- Change in current consumption;
- Change in discharge head / flow rate;
- Change in switching frequency;
- Increase in noise and vibration levels.

To make sure that the pump is always ready for instant start-up, the pump unit must be started up approximately every 2 weeks for approx. 5 minutes during prolonged shutdown periods. This will prevent the formation of deposits in the bearing and impeller clearances.

The borehole pumps need not be removed from the well/tank regularly for inspection.

WARNING
If a pump has been used for a liquid which is hazardous to health or toxic, the pump will be classified as contaminated.

11.2 Repair / Spare parts

For information concerning repair jobs and spare parts please contact your nearest KSB service centre.

For any queries and repeat orders, particularly when ordering spare parts, please specify the following information (see name plate):

- Pump and motor type and size;
- The operating data.

12 Failures

12.1 Failure table

WARNING
Observe the general safety precautions for installation, maintenance and repair.

WARNING
System pressure must be released before attempting to remedy faults on parts which are subjected to pressure.

Problem	Possible cause	Possible solution	Checkpoints
Pump is running, but does not deliver.	Lack of voltage.	Check the electrical installation. Notify the energy supply company.	
	Pump is clogged by sand.	Clean suction casing, impellers, stage casings and check valve.	
	Motor winding or electric cable are defective.	Contact KSB.	
	Defective or clogged riser pipe (pipe and sealing elements).	Replace affected; fit new sealing elements.	
	Impermissible air or gas content in the liquid.	Contact KSB.	

Problem	Possible cause	Possible solution	Checkpoints
Pump delivers insufficient flow rate.	Wrong direction of rotation (in case of 3~).	Interchange two of the phases of the power supply cable.	
	Wear of internal components.	Replace worn components by new ones. Contact KSB.	
	Motor is running on two phases only.	Replace the defective fuse, check the electric cable connections.	
	Defective or clogged riser pipe (pipe and sealing elements).	Replace affected; fit new sealing elements.	
	Water level lowered too much during operation.	Contact KSB.	
	NPSH-available (positive suction head) is too low.	Submerge pump deeper.	
	Speed is too low.	Check voltage and increase, if necessary. Contact KSB.	
	Pump delivers against an excessively high discharge pressure.	Open the shut-off valve further to re-adjust to duty point.	
Insufficient discharge head.	Pump delivers against an excessively low discharge pressure.	Close the shut-off valve further to re-adjust to duty point.	
	Deposits in the impellers.	Remove deposits.	
	Wrong direction of rotation (in case of 3~).	Interchange two of the phases of the power supply cable.	
	Wear of internal components.	Replace worn components by new ones. Contact KSB.	
	Defective or clogged riser pipe (pipe and sealing elements).	Replace affected; fit new sealing elements.	
	Impermissible air or gas content in the liquid.	Contact KSB.	
	Speed is too low.	Check voltage and increase, if necessary. Contact KSB.	
Vibrations and noise during pump operation.	Deposits in the impellers.	Remove deposits.	
	Impermissible air or gas content in the liquid.	Contact KSB.	
	Mechanical defect on pump or motor.	Contact KSB.	
	System-induced vibrations	Contact KSB.	
	NPSH-available (positive suction head) is too low.	Submerge pump deeper.	

Problem	Possible cause	Possible solution	Checkpoints
Unit tripped by overcurrent relay	Motor is running on two phases only.	Replace the defective fuse, check the electric cable connections.	
	Pump clogged by sand.	Clean suction casing, impellers, stage casings and check valve. Contact KSB.	
	Motor winding or electric cable are defective.	Contact KSB.	
	Defective overcurrent relay.	Check and replace, if necessary.	
	Motor winding not suitable for operating voltage available.	Replace the pump unit. Contact KSB.	
Fuses have blown.	Motor winding or electric cable are defective.	Contact KSB.	
	Wrong fuse size.	Fit correct fuse size.	
Unit cannot be switched on.	Lack of voltage.	Check the electrical installation. Notify the energy supply company.	
	Motor winding or electric cable are defective.	Contact KSB.	
	Defective overcurrent relay.	Check and replace, if necessary.	
Unit cannot be switched of.	Defective overcurrent relay.	Check and replace, if necessary.	

13 Annexes

13.1 Parts list UPA 150C

Pos. nr.	Description
52-4	Locking sleeve
58-1	Protection plug
81-39	Clamp
106	Suction casing
108.01	Stage casing
108.02	Stage casing with holes
108.05	Upper stage casing
143	Suction strainer
145	Adapter
210	Shaft
230	Impeller
316	Thrust bearing
371	Counter thrust bearing
412.01	O-ring
502	Casing wear ring
503	Impeller wear ring
545	Bearing bush
550	Disc
751	Valve body
752	Valve seat
756	Valve spring
759	Valve plate
825	Cable guard
(849)[1]	Coupling
905	Tiebolt
914.01	Hexagon socket head screw
914.02	Hexagon socket head screw
914.03	Hexagon socket head screw
920	Nut
922	Impeller nut

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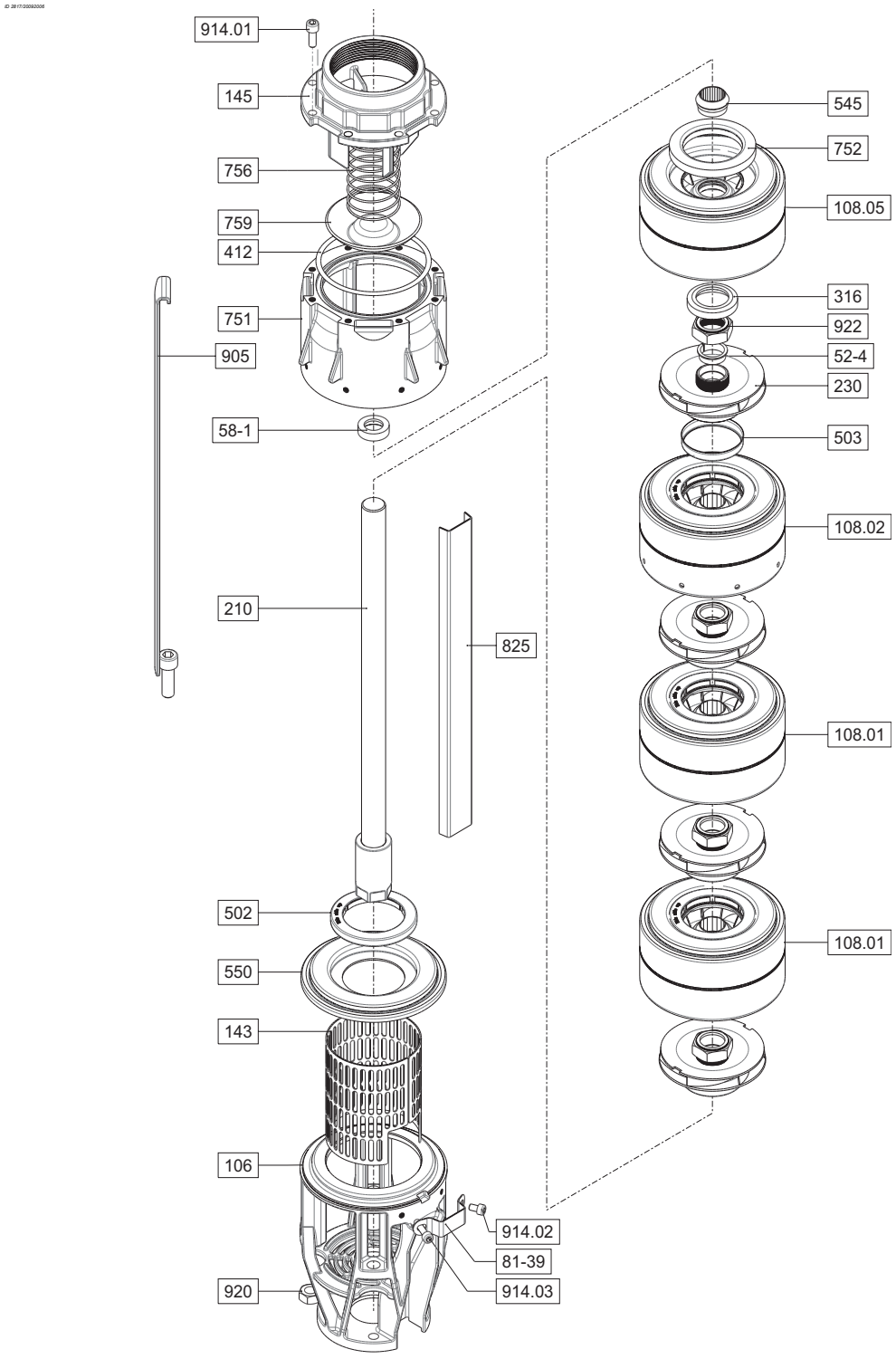
1. Rigidly connected to shaft 210

13.2 Exploded view UPA 150C 16



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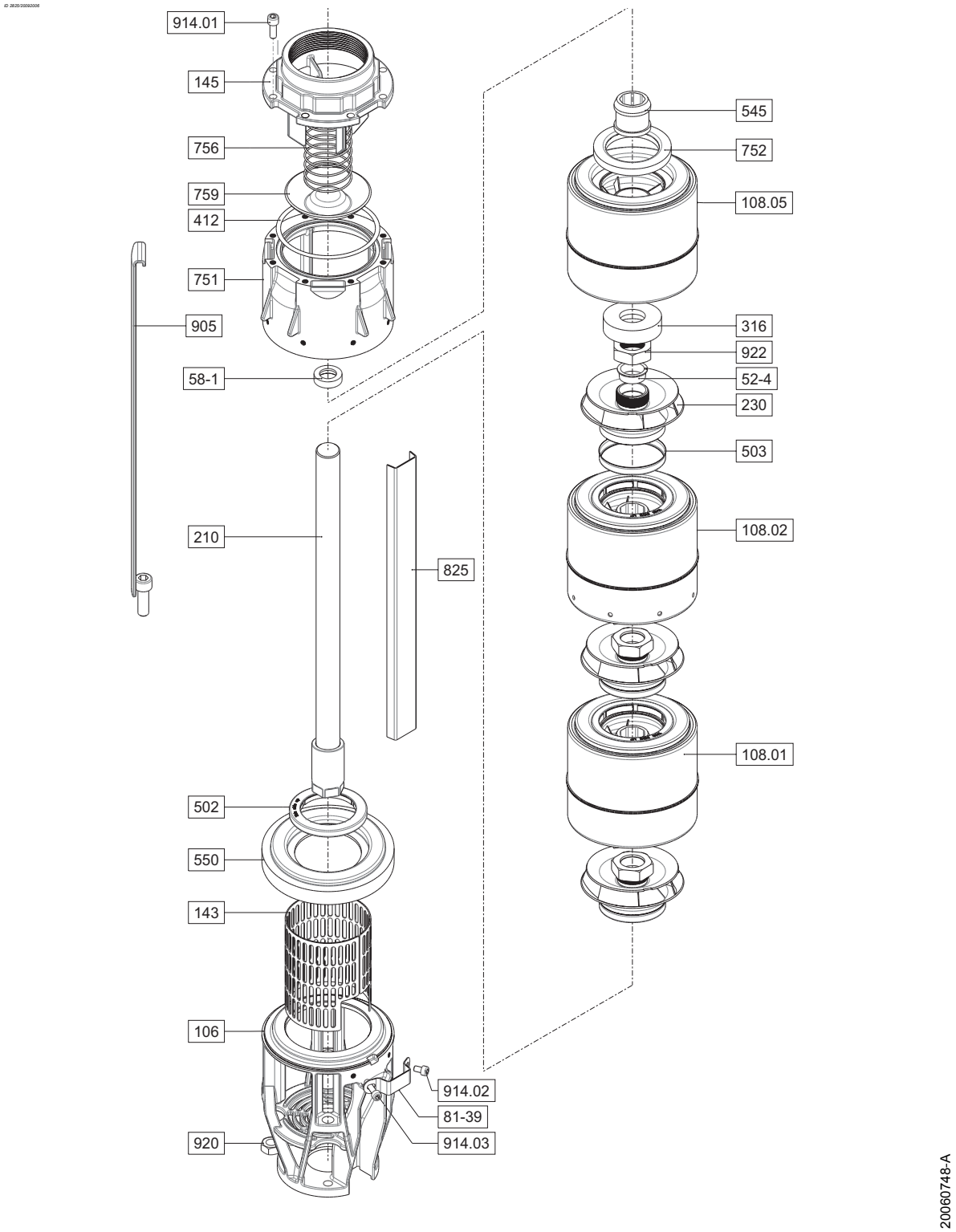
13.3 Exploded view UPA 150C 30



Motors ≤ 1 kV

Caution:

These operating instructions contain fundamental information and precautionary notes. Please read the manual thoroughly prior to installation of unit, connection to the power supply and commissioning.
It is imperative to comply with all other operating instructions referring to components of this unit.

Caution:

Please observe the operating instructions of the pump UPA 150C.

Name plate

Before installing the unit, we recommend to copy the name plate data into the space below or to stick in the name plate label enclosed with the delivery.

Works No.:			
Pump:			
Q_{min}	m^3/h	H_{max}	m
Q_{max}	m^3/h	H_{min}	m
Q	m^3/h	H	m
3~ motor:			
kW		Hz	1)
V 2)		A	cos φ
V 2)		A	cos φ
Temperature t_{max} = +		°C	rpm
Min. flow velocity past the motor		v_{min} =	m/s
VDE 0530 Part 1		IP 68	

ZN 3823 - D 139 / D 88

1) Version for two electrical motor leads
2) Possible supply voltages.

Quick-reference instructions (check list)

Procedure for installation and commissioning:

1. Unpack unit and support (3).
2. Check installation conditions (4.2).
3. Prepare support for vertical or horizontal installation (4.2).
4. Have tools and equipment ready (5.1).
5. Instructions for filling the motor (5.2).
6. Connect extension cable to the motor lead by means of cable connector (5.5).
7. Install electric shock protection (5.6).
8. Install or set up submersible unit and connect riser pipe or discharge pipe (5.7).
9. Attach cable to riser or discharge pipe continuously during installation (5.8).
10. Connect cable to control box (5.9).
11. Start up the unit (6).

Submersible Motors Franklin DN 100, UMA 150D

for supply voltages up to U = 1000 V
Frequency: 50 or 60 Hz
Rotational speeds: ≈ 2900 (1450) rpm /
≈ 3550 (1750) rpm

Certification

Quality management certified to ISO 9001

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1 General

1.1 Applications

The submersible motors DN 100 and UMA 150D serve to drive a submersible motor pump.

1.2 Product details

The name plate on the motor specifies

- the works number,
- the type series / size,
- the main operating data,
- max. allow. fluid temperature t_{max} in °C,
- minimum flow velocity past the motor v_{min} in m/s.

Before installing the unit, we recommend to copy the name plate data into the space provided on the cover sheet of the operating manual or to stick in the name plate label enclosed with the delivery.

Overall length and weight of the pump units are indicated in the order confirmation / shipping documents.
Sound pressure level: ≤ 75 dBA!

1.3 Technical codes

The submersible borehole pumps meet the fundamental safety requirements as per EC directives “Machinery 98/37/EC”, “Electromagnetic compatibility 89/336/EEC” and the EC directive on low-voltage equipment 73/23/EEC.

Compliance with these directives is confirmed by the EC declaration of conformity provided with each delivery and the CE marking affixed to the product itself.

If a pump is supplied without motor or a motor is supplied without pump, compliance with EC directives is confirmed by the EC manufacturer’s declaration.

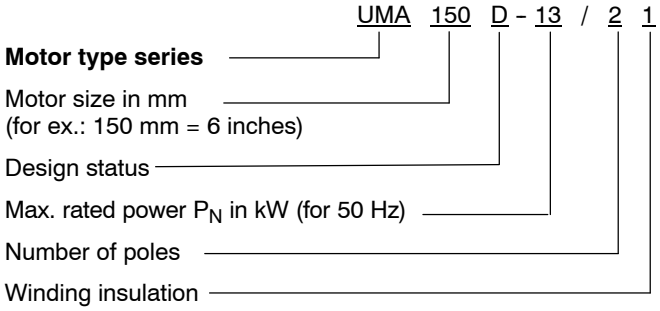
The EC declaration of conformity is issued and the CE marking affixed by the party assembling the pump and the motor to form a complete pump unit.

Other applicable regulations (e.g. VDE, DIN, IEC etc.) are referred to in the individual chapters, where necessary.

1.4 Sales and service addresses

The addresses of our sales and service organization are listed in the enclosed ”Service Addresses” booklet (ref. No. 0092.01). The address of the KSB factory responsible is printed on the back of this operating manual.

1.5 Designation (example)


UMA 150 D – 13 / 2 1
Motor type series
Motor size in mm
(for ex.: 150 mm = 6 inches)
Design status
Max. rated power P_N in kW (for 50 Hz)
Number of poles
Winding insulation

1.6 Scope of supply

CAUTION:
The motor lead must always be laid under water only!

The submersible borehole pumps are delivered with Franklin DN 100, UMA 150D motors pre-filled at the factory.

The motors are supplied with 1 or 2 electric motor leads or – in the case of motors with high power rating – with 7 individual cables. The motor lead is designed for use in water.
Please contact KSB if the system configuration is such that the entire motor lead or part of it is operated in air.

On request, pump units are available with:

- motor lead and extension cable connected with cable connector or
- complete electric cable connected in the motor.

2 Safety

These operating instructions contain fundamental information which must be complied with during installation, operation and maintenance. Therefore this operating manual must be read and understood both by the installing personnel and the responsible trained personnel / operators prior to installation and commissioning, and it must always be kept close to the location of operation of the machine / unit for easy access.

Not only the general safety instructions laid down in this chapter on ”Safety” must be complied with, but also any specific safety instructions outlined in other sections of this manual, e.g. for private use.

2.1 Marking of instructions in the manual

The safety instructions contained in this manual whose non-observance might cause hazards to persons are specially marked with the symbol

when there is a general hazard (safety sign to DIN 4844 - W9) and

where there is a risk of electric shocks (safety sign to DIN 4844 - W8).

The word **”CAUTION”** is used to introduce safety instructions whose non-observance may lead to damage to the machine and its functions.
Instructions attached directly to the machine, e.g. ”Check motor fill” (green sticker) etc., must always be complied with and be kept in perfectly legible condition at all times.

2.2 Personnel qualification and training

All personnel involved in the operation, maintenance, inspection and installation of the unit must be fully qualified to carry out the work involved.

Personnel responsibilities, competence and supervision must be clearly defined by the operator. If the personnel in question is not already in possession of the requisite know-how, appropriate training and instruction must be provided.

If required, the operator may commission the manufacturer / supplier to take care of such training. In addition, the operator is responsible for ensuring that the contents of the operating instructions are fully understood by the responsible personnel.

2.3 Non-compliance with safety instructions

Non-compliance with safety instructions can jeopardize the safety of personnel, the environment and the machine / unit itself.
Non-compliance with these safety instructions will also lead to forfeiture of any and all rights to claims for damages.
In particular, non-compliance can, for example, result in:

- failure of important machine / unit functions,
- failure of prescribed maintenance and servicing practices,
- hazard to persons by electrical and mechanical effects.

2.4 Safety awareness

It is imperative to comply with the safety instructions contained in this manual, the relevant national health and safety regulations and the operator's own internal work, operation and safety regulations.

2.5 Safety instructions for the operator / user

Electrical hazards must be eliminated. In this respect refer to the relevant national (VDE for Germany) or European (IEC) safety regulations and to the regulations of the local energy supply company.

2.6 Safety instructions for maintenance, inspection and installation work

The operator is responsible for ensuring that all maintenance, inspection and installation work be performed by authorized, qualified specialist personnel who are thoroughly familiar with the manual.
Work on the machine / unit must be carried out only during standstill. The shut–down procedure described in the manual for taking the unit out of service must be adhered to without fail.
Immediately following completion of the work, all safety-relevant and protective devices must be re-installed and / or re-activated.
Please observe all instructions set out in section "6.3.4 Returning to service" before returning the unit to service.

2.7 Unauthorized modification and manufacture of spare parts

Modifications or alterations of the equipment supplied are only permitted after consultation with the manufacturer. Original spare parts and accessories authorized by the manufacturer ensure safety. The use of other parts will invalidate any liability of the manufacturer for consequential damage.

2.8 Unauthorized modes of operation

The warranty relating to the operating reliability and safety of the unit supplied is only valid if the equipment is used in accordance with section "1.1 Applications" of the operating instructions. The limits stated on the name plate / order confirmation must be adhered to without fail.

3 Transport and interim storage

Take into account the unequal weight distribution between pump and motor!

Use suitable lifting tackle (e.g. straps)!

Always make sure that the motor resp. submersible borehole pump cannot tip over!

CAUTION:
Always protect electric cabling from mechanical damage!

CAUTION:
Do not pull on the electric cable!

CAUTION:
The pump units must be stored in vertical position!

Transport of a submersible borehole pump requires proper preparation and handling.
Only approved transport equipment and lifting gear shall be used. The motor resp. pump unit is supplied in packaging which largely prevents sagging or other damage during transport and storage.
Prior to and during unpacking, check whether the packaging has been damaged.
When opening the packaging or handling the motor resp. pump unit make sure not to damage the power cable. Never pull on the electric cable! This could lead to initially undetected damage to the connecting element in the motor or the cable itself.
When using a fork-lift truck to transport the motor resp. pump unit in horizontal position, make sure to take into account the very unequal weight distribution between pump and motor. Normally, the centre of gravity will be in the motor area. When transporting the unit in horizontal position with a crane, slings points shall be chosen to prevent excessive bending stresses on the unit, e.g. in the middle of the motor and at the upper end of the pump.
Use suitable lifting tackle (e.g. straps). The use of chains or steel wires is not recommended, as there is a risk of the chains / wires slipping, resulting in personal injury and/or damage to property.
Always make sure the motor resp. pump unit is properly secured when standing vertically. Otherwise, the unit may tip over and cause personal injury or damage to property.
The free end of the electric cable is fitted with a protective cap to prevent the ingress of moisture and dirt. This cap should not be removed until immediately before connection to the extension cable or control box.
For special pump models (e.g. with pump shroud, etc.) also follow the instructions given in the enclosed supplementary pages listed in section 12, if any.
For interim storage, the instructions given in section 6.3.2 "Storage" must be observed.

4 Description of the product, accessories and installation types

4.1 Technical specification

The submersible motor is an electric motor with is rigidly connected to the pump. They are designed in principle for vertical, stationary use in water. With the restrictions described in section “Operating instruction of the pump”, they can also be installed horizontally.

The liquid fill in the motor lubricates the bearings and cools the space inside the motor. On UMA motors, it also cools the windings sealed with water-tight insulation material.

The shaft is sealed by a high-quality mechanical seal.

At the lower end of the unit, a thrust bearing absorbs the pump’s hydraulic thrust and the rotor weight of pump and motor. Pressure differences between the motor and environment are equalized by a rubber expansion diaphragm.

Also refer to the enclosed sectional drawings with list of components of pump and motor.

Note: When added at the factory, the motor fill meets food protection regulations.

4.2 Installation conditions

4.2.1 Minimum submergence

CAUTION:
The submersible motor must only be operated when fully submerged.
For specific installation conditions please refer to the operating instructions of the pump UPA 150C.

4.2.2 Angled installation

Contact the KSB factory.

4.2.3 Flow velocity ”v” past the motor (see section 8)

As standard and dependent on the fluid temperature, a forced flow must pass along the motor. The max. permissible temperature T_{max} and the associated flow velocity v_{min} of this forced flow are indicated on the name plate / in the order confirmation. The flow velocities v indicated there depend on the outside diameter of the motor in question and on the following installation conditions.

♦ Standard: v ≥ 0.2 m/s ...
This requirement is complied with if the units are installed as follows:
Vertical installation
- in deep wells:
  The unit is installed above the well screen / filter. The pump draws water from below, which ensures a continuous water flow past the motor,
- in reservoirs, etc.:
  The unit is freely suspended in the water and the water inlet is below the motor.

In the following cases we recommend to use a special **cooling shroud** to ensure the required water flow past the motor:
- in deep wells:
  if the unit is installed below the well screen / filter,
- in reservoirs, etc.:
  if the unit is freely suspended in the water and the water inlet is located above the motor, or if the unit is suspended in a separate pump sump (see fig. 2).

For shroud dimensions please refer to section 8.

Horizontal installation
Depending on the motor size, it will be necessary to install a device guiding the flow along the motor (cooling shroud, flow inducer sleeve, etc.) in this case. See operating instructions of the pump and specifications in the order documentation, if applicable.

♦ Variant v ≥ 0.5 m/s
This requirement is complied with if the units are installed as follows:

Vertical installation
If the ratio of the outside motor diameter and the inside well diameter DN meets certain conditions or if the unit is installed in a suitably sized (cooling) shroud. Please refer to section 8 and any information provided in the order documentation.

Horizontal installation
In this case special measures are required. Please observe any information in the order documentation.

♦ Variant v = 0 m/s
No forced flow is required here.
Note: When the motor is running, a flow is generated around the motor by the heat dissipated, irrespective of the installation situation. The operator must ensure that this flow is not obstructed by installation conditions on site (see also section 5.10.4)!

4.2.4 Water quality

The submersible motor pumps are suitable for operation in clean or slightly contaminated water of the following quality:

a) Temperature of the fluid pumped
The max. permissible temperature T_{max} and the required minimum flow velocity v_{min} are indicated on the name plate / in the order confirmation.
For higher temperatures please contact the factory.

b) Sand content
Maximum sand content: up to 50 g/m^3.
Higher sand contents may be permitted for more wear-resistant pump variants.
Please refer to the information provided in the order documentation.

c) Aggressiveness
There are defined material variants available for the following water qualities:
- **standard variant** for neutral or slightly aggressive water, or
- **special variant** for more aggressive water.

Other water qualities (e.g. sea water) can be handled by other special materials, as required.
Please refer to the information provided in the order confirmation.

d) Ochre content
If the unit is operated in water with a high ochre content, the suction strainer may be clogged with ochre so that the unit must be prematurely removed from the well. In the case of otherwise clean water and if the unit is installed well clear of the filter zone, we recommend to remove the suction strainer before the pump is installed for the first time.
Also, ochre deposits may form on the motor (in the stator area), which will affect motor cooling. In such cases, a temperature monitoring device (Pt 100 resistance thermometer) is absolutely required.

5 Installation at site

5.1 Installation tools and equipment

Use suitable lifting tackle (e.g. straps)!

Always make sure that submersible borehole pumps cannot tip over!

Installation and removal of submersible borehole pumps requires suitable lifting gear (e.g. tripod, mobile crane, etc.). Its load-carrying capacity must be greater than the weight of pump unit / riser pipe with water fill (see table below and table in 5.2), power supply cable, holders, etc. Use suitable lifting tackle (e.g. straps). The use of chains or steel wires is not recommended, as there is a risk of the chains / wires slipping, resulting in personal injury and / or damage to property.
For details please refer to the operating instructions of the pump UPA 150C.

5.2 Motor fill

Quality of motor fill
When filling the motors or topping up the motor fill use water in compliance with the European drinking water directive (normal clean drinking water) or a drinking water / antifreeze mixture (1,2 propylene glycol), depending on the motor type (see information on green or red sticker). See also section 5.2.2, “Protection against freezing”.

Wear safety glasses and protective gloves when handling (topping up, checking and draining) the motor fill. The national health and safety regulations shall be observed. The mixture must be disposed of in compliance with local applicable regulations.

Checking the filling level of the motors
The procedure for checking the filling level and topping up the motor fill differs depending on the motor concerned.
A distinction is made between the following motors:
- Franklin DN 100:
  encapsulated motors, pre-filled at the factory
- UMA 150D:
  rewindable motors, pre-filled at the factory

Motors pre-filled at the factory are filled with a water-antifreeze mixture! These motors can be stored at ambient temperatures $t \geq -15$ °C.

The water fill of the motors is **roughly** as follows:

UMA 150D	5/21: 3.2 l	UMA 150D	18/21: 3.9 l
	7/21: 3.3 l		22/21: 4.0 l
	9/21: 3.4 l		26/21: 4.2 l
	13/21: 3.6 l		30/21: 4.3 l
	15/21: 3.7l		37/22: 4.5l

5.2.1 Franklin DN 100 and UMA 150D motors

CAUTION:
If these motor types have been stored or taken out of service for one year or longer, the motor fill must be checked prior to installation.

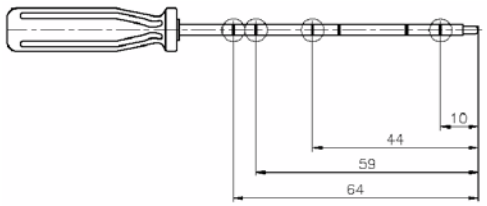
CAUTION:
Use clean drinking water for topping up the liquid fill, or – even better – use the original filling liquid.

CAUTION:
Only the original filling liquid shall be used when the complete motor fill has to be renewed after repair work or when the liquid fill has to be replaced.

Franklin DN 100 motors with axial loads of 1500 N, 3000 N and 4000 N
1. Place motor vertically, with diaphragm cover pointing upwards. Make sure not to place it onto the shaft.
2. Unscrew the three slotted screws at the diaphragm cover and take off the diaphragm cover. Then take out the diaphragm.
3. The motor fill should reach halfway up the diaphragm housing. If not, top up with clean water (do not use distilled water). It is better to use the original filling liquid, however, as it will ensure sufficient protection against freezing.

Franklin DN 100, UMA 150D motors with axial load of 6500 N
Standard material UMA 150D motors are provided with a filler valve to the left and a pressure relief valve to the right of the earthing bolt at the upper bearing end plate. UMA 150D motors in special material variant, and DN 150 and DN 100 motors with an axial load of 6500 N are provided with a filler valve only. Depending on the model, the valve may be plugged with a filter plug or a plug with or without filter insert. The filler valve allows trapped air to escape and serves to top up liquid. Small amounts of liquid escaping when storage temperatures are high are no cause for alarm.

Tools and diaphragm distances
A filling kit (ident. No. 90 066 762) is required for topping up and checking the liquid fill.
The filling kit comprises: filling syringe, test pin and filter plugs.
Correlation of diaphragm distances and test pins with motor type



Motor type series	Variants	Distance required (A)
UMA 250D	Standard / special	64 mm +/– 2 mm
UMA 200D	Standard / special	44 mm +/– 2 mm
UMA 150D	Standard / special	44 mm +/– 2 mm
DN 150		59 mm +/– 2 mm
DN 100	Axial load 6500N	10 mm +/– 2 mm

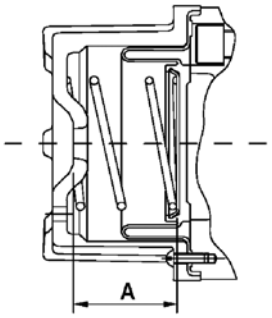


Fig. 4 : Diaphragm distance
DN 100, DN 150 and UMA 150D

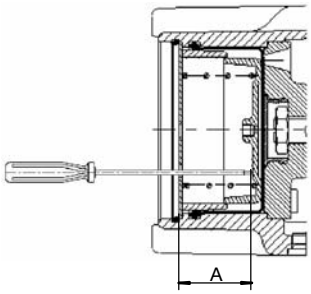


Fig. 4: Diaphragm distance
UMA 200D and UMA 250D

The description below refers to UMA 150D motors in standard material variant and applies by analogy to UMA 150D motors in special material variant, UMA 200D, UMA 250D as well as DN 150 and DN 100 motors with axial load 6500 N.

Proceed as follows:

Venting the motor

1. Place the motor (pump unit) carefully in horizontal position and support in such a way that the filler valve (2) is at the highest point.
2. Take the filter plug (21) out of the filler valve in the upper bearing end plate.
3. Carefully insert the test pin (1) into the filler valve and vent until liquid escapes.

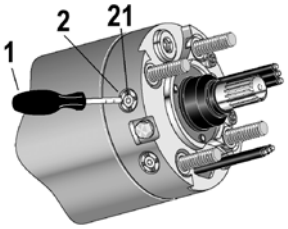


Fig. 5 Venting the motor

Checking the motor fill

4. Insert the test pin carefully through the hole (3) in the diaphragm housing until resistance can be felt.
5. Measure the distance between the diaphragm and the edge of the hole in the diaphragm housing and compare the result with the required distance A given in the table.
6. If the diaphragm distance falls short of the required value, the motor is overfilled. Drain filling liquid through the filler valve (see "Venting the motor").
   If the required value is exceeded, filling liquid must be topped up through the filler valve.

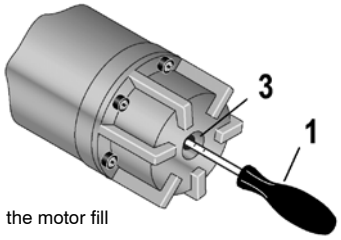


Fig. 6 Checking the motor fill

Topping up motor fill

7. Press the filling syringe (4) against the filler valve and top up motor fill until the diaphragm distance measured is below the required value A.
8. Adjust diaphragm distance to required value A by draining (see "Venting the motor") or topping up motor fill, as required.
9. Re-insert the filter plug (21) in the filler valve.

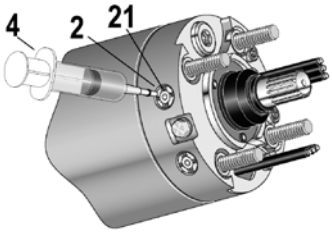


Fig. 7 Topping up the motor

5.2.2 Protection against freezing

When handling 1,2 propylene glycol antifreeze, we recommend to wear safety goggles and protective gloves!

If there is a risk of freezing for the filled motor, 1,2 propylene glycol antifreeze must be added to the water fill as follows, depending on the anticipated below-zero temperature:

Temperatures down to ...	Water (% by vol.)	1,2 propylene glycol (% by vol.)
– 10 °C	75	25
– 15 °C 1)	**66** 1)	**34** 1)
– 20 °C	62	38
– 25 °C	57	43
– 30 °C	53	47

1) water-antifreeze mixture filled in at the factory

When handling 1,2 propylene glycol, wear safety goggles and protective gloves. The antifreeze must be disposed of in compliance with local applicable regulations.
1,2-propylene glycol is commercially available in the following brands:

Manufacturer	Trade name
BASF	Glythermin P 44
BP	Thermofrost P
Chemische Werke Hüls	ILEXAN P

The above order of producers is purely alphabetical and does not imply any quality ranking of individual products!

5.3 Pump sets in suction, cooling or pressure shrouds

The submersible borehole pumps can also be equipped with suction, cooling or pressure shrouds.

For pump models with vertical suction shroud, the pump set and the shroud are generally delivered as separate items. The pump set is then installed into the shroud on site.

Pump sets with horizontal suction shroud as well as vertical and horizontal pressure shrouds are generally delivered with the pump set already installed in the shroud. In this case, special filling and vent lines are provided for checking and adding the motor fill.

Also refer to any additional instructions given in the order documentation.

5.4 Check valve / Connection branch

CAUTION:
Submersible borehole pumps are not designed for uncontrolled backflow of the fluid through the pump. Suitable precautions must be taken to prevent reverse rotation of the pump.

The pump may reach inadmissible rotational speeds which will eventually damage the motor.

5.5 Connecting the electric extension cable (cable connector)

The electric cable shall be connected by a trained electrician only!

CAUTION:
The extension cable provided by us is designed for use freely exposed to air and in contact with surfaces!

If required, an extension cable can be connected to the motor lead using a watertight **cable connector** available from KSB. These cable connectors are approved for supply voltages up to U = 1000 V (low voltage).

The extension cable must be connected by a trained electrician only.

The extension cable included in our scope of supply is designed for use freely exposed to air and in contact with surfaces and for a voltage drop along the cable of $\Delta U \leq 3\%$ (incl. motor lead). For other cable installation methods, e.g. in cable ducts, etc., please observe the instructions set forth in VDE 0298.

The cable connector shall be fitted as described in the assembly instructions enclosed with the cable connector.

When connecting the extension cable, make sure that the terminal identifications of the motor lead are transferred to the extension cable and that the conductor colours are properly matched. (Also refer to section 5.9.3 Terminal designation.)

On shielded extension cables, the shield must be connected at both ends. At the motor lead, the shield must be connected to the earth conductor. In the case of three-core motor leads without earth conductor, the motor must also be earthed externally. This earth conductor (core size corresponding to phase conductor; min. 4 mm^2) must be connected to the shield.

Example: The extension cable conductor connected to "U1" in the cable connector must be identified "U1" at its free end (to be connected to control box).

See wiring principles, sections 9 and 10.

5.6 Protection against electric shock

Protection against electric shock must be provided (earthing)!

Equipment connected to the electric power supply must have some form of protection (earthing) to prevent electric shocks. This is a statutory requirement stipulated by VDE 0100 (for Germany) or IEC 64. The submersible borehole pumps are always earthed. There are two variants available:

a) Internal earthing: The earth conductor has been connected internally to the stator at the factory. One (4-core) or two (3- and 4-core) leads with integrated earth conductor is / are brought out from the motor. It is the operator's responsibility to ensure that the earth conductor is properly connected in the cable connector and in the control box at the site.

b) External earthing: The earth conductor is connected to the outside of the upper bearing carrier of the motor (earthing bolt) at site by the operator. 1 or 2 leads with 3 cores each, or the corresponding number of single-core leads, are brought out from the motor.
Application: Protective earthing for motors with 1 or 2 three-core leads and for motors with single-core leads, or for additional potential equalization.

5.7 Installation at site

Take suitable precautions to prevent anyone from falling into the well / reservoir / tank!

CAUTION:
Protect electric cabling from mechanical damage! Protect open cable ends against moisture and dirt.

During installation work, suitable precautions shall be taken to protect anyone from falling into the open well / reservoir / tank. Suitably fence off the work area.
During the entire installation procedure the electric cabling must be adequately protected to prevent mechanical damage. Tools, equipment or accessories with sharp edges (e.g. sharp-edged pipe sockets) shall not be used during installation. For special conditions please refer to the operating instructions of the pump UPA 150C.

5.7.1 Re-installing the pump unit

Before re-installing the pump unit (e.g. after on-site repair) check the free radial and axial movement of the rotor. Depending on the size and weight of the pump unit, this must be done separately for the motor and the pump. Also, rotor position (pump and motor) and axial clearance have to be checked. For large pump units, auxiliary equipment will be required. This work should be performed by trained personnel only.

If the rotor cannot be turned or lifted, we recommend that you contact our nearest service centre or the KSB factory in charge.

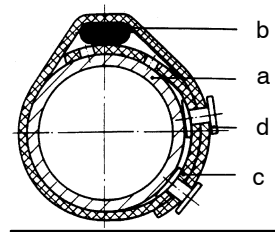
In addition, the winding insulation resistance must be checked, unless this has already been done during winding repair or when connecting the extension cable. The winding insulation resistance should be measured by a trained electrician only.

Procedure:

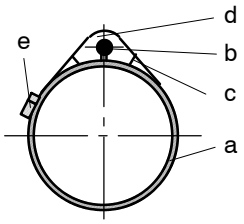
- The filled motor has been submerged in water for at least 12 h, incl. the power cable. (Do not submerge the cable ends – they must be protected against moisture!)
- Measuring voltage: 1000 V d.c.
- Measure insulation resistance to earth.
- Values required at an ambient temperature of 20°C and a cable length of 5 m:
  Winding insulation J1: = 20 megohm
  Winding insulation J2: = 500 megohm

Other resistance values may be measured, depending on water temperature, the length and quality of the power cable and the motor's operating hours. If the resistance measured is lower than the values specified above please contact the KSB factory responsible.

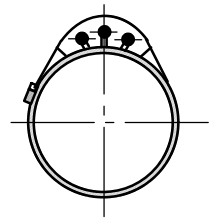
5.8 Fixing the electric cable to the riser pipe
(cable ties)



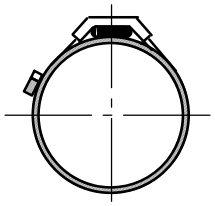
Size 1:
a = riser pipe
b = electric cable
c = rubber strap
d = plastic stud



Sizes 2, 3, 3a, 3b, 4:
a = riser pipe
b = electric cable
c = metal strap
d = cable protector
e = screw band with tension screw



Sizes 6-9



Size 11

Fig. 14 Cable ties

Tighten the ties firmly to ensure that the electric cable cannot slip downwards!

5.8.1 Cable tie size 1 (rubber)

This cable tie (rubber strap + plastic studs) can be used for the following cables:

- flat, 3- and 4-core, 1.5 mm^2 to 6 mm^2 and
- round, 4-core, 1.5 mm^2 to 6 mm^2.

Procedure (see also fig. 14):

1. Cut the rubber strap to the following length, depending on the diameter of the riser pipe (DN/R):

DN (mm)	50	80	100	125	150
R (inch)	2	3	4	5	6
L (mm)	320	400	450	500	600

The strap shall always be cut half way between two holes.

2. Place one plastic stud ”d” into the third and fourth hole, respectively, and then wrap the strap ”c” around the riser pipe ”a” in such a way that one end is beneath the cable ”b”.
3. Wrap the other end around the riser pipe and cable and fix it to the stud. Tighten the rubber strap firmly to ensure that the electric cable cannot slip downwards by its own weight!

5.8.2 Cable tie sizes 2 - 11 (metal)

This type of cable tie (metal + rubber cable protector) is used for **larger cables** than those referred to in section 5.8.1.

Procedure (see also fig. 14):

1. Cut metal strap ”c” to the required length L (L = circumference of riser pipe + approx. 200 mm allowance) and bend both ends inwards by approx. 100 mm.
2. Extend the screw band ”e” to its full length by loosening the tension screw and hook it into one end of the metal strap.
3. Place cable protector ”d” around cable ”b” and against riser pipe ”a”, using the metal strap. Then hook the screw band into the other end of the metal strap.
4. Tighten the tension screw on the screw band with a screwdriver so that the electric cable cannot slip downwards by its own weight!

5.9 Connection to power supply (in control box)

Observe the applicable regulations!

The motor shall be connected by a trained electrician only!

Electrical installation must comply with national regulations (e.g. VDE 0100, 0113 for Germany) or IEC 64.
The motor must be connected by a trained electrician only.

5.9.1 General

When connecting the motors, the following instructions shall be observed:

- Check available mains voltage against the data on the motor name plate.
- Permissible voltage/frequency fluctuations from the values specified on the name plate / in the order confirmation: VDE 530 T1 zone A; $U_N \pm 5\%$, $f_N \pm 2\%$.
- The motors are designed for short-time operation with shifted star point (t < 1h). For prolonged operation and $U_0 > 0.2 \times U_N$ please contact the factory.
- The power rating specified on the name plate and in the order confirmation applies to continuous operation S1 to VDE 530T1 or IEC 34-1.
- Als Motorschutz ist ein temperaturkompensiertes Überstromrelais der Auslöseklasse 10 oder 10A vorzusehen. If an earth leakage relay is used, it must be fitted in the motor power circuit.
- If the unit is to be operated with a soft starter or speed control equipment (e.g. with frequency inverter), sections 5.9.2 and 6.1.5 of this manual shall be consulted prior to commissioning.

5.9.2 Starting methods

As a rule, submersible borehole pumps from KSB are designed for d.o.l. starting.
If this starting method is not permitted in the mains, starting devices must be used to reduce starting currents, except for DN 100 motors. Suitable methods are: star-delta contactors (Y-Δ), autotransformers or starting resistors as well as soft starters. Please refer to the order confirmation to check if the starting device chosen is acceptable.
The starting devices must be set up for automatic operation, i.e. switchover from Y to Δ or from partial to full voltage must be automatic.
Due to the small moments of inertia of submersible borehole pumps and the resulting extremely short run-up period, compliance with the following instructions is important:

a) Star-delta contactor, autotransformer and starting resistor:

The Y-phase or partial voltage period shall not exceed 4 s. The switchover interval from Y to Δ must not be longer than 60 ms (additional delays are not permitted).
If the unit is operated with a starting transformer or resistor, a closed-transition switchover method shall be chosen (Korndorfer connection).

b) Soft starter:

CAUTION:
Incorrect parameter settings present a hazard to the motor. Conspicuous noises or vibrations may well be an indication of incorrect settings.
Soft starters electronically reduce the incoming line voltage and, hence, the initial starting torque and starting current of electric motors. During run–up they gently ramp up the applied voltage to the motor. Due to their extremely slim design and resulting small moments of inertia, submersible borehole pump motors have a number of special features which differ considerably from the normal, standardized asynchronous motor type.

Effects on submersible borehole pumps

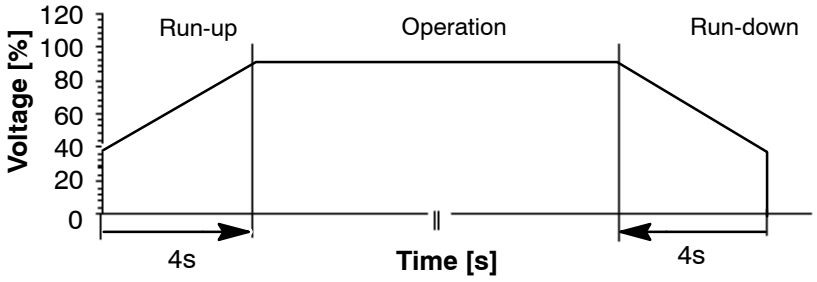
- Starting current ⇒ approx. 40% to 65% of I_A required for d.o.l. starting.
- Running-up time t_H increased to approx. 1s to 3s compared with approx. 0.2s to 0.5s for d.o.l. starting.
- Starting torque M_A roughly 1/4 of the direct-starting torque.
- No current or torque peaks (I_A, M_A), as in start-delta switching arrangement.
- Hydraulic pressure surges (water hammer) upon starting and stopping of the pump can be reduced, but not fully eliminated. Therefore, soft starters are not suitable for solving water hammer problems. This would require the use of hydraulic control equipment or a frequency inverter. To prevent effects due to power failure, additional measures are required.

Note:
Conspicuous noises during run–up could well be an indication of incorrect settings on the soft starter, such as excessive ramp times, wrong operating mode (control), activated special functions, etc.

Soft starter settings

Parameter / Function	**Setting**	**Notes**
Minimum starting voltage	40% of the motor's rated voltage	
Ramp time / acceleration (run-up) time	< 4s	Ramp time is not identical with the motor's actual running-up time
Current limitation	I_A / I_N preset to approx. 3.5	Should only be altered with allowance for t_H < 4s
Deceleration (run-down) time / stop ramp	Deceleration time t_A < 4s	Better without a ramp.
Special functions, e.g.: – special "pump function" – kick-start / boost function – speed adjustment – current control – cos φ- / economy function – delayed starting	Off	Usually excluded, as they tend to be troublesome, particularly in submersible borehole applications.

The soft starter must remain bridged (bypassed) as long as the pump is in operation in order to avoid power losses in both the starter and the motor and to ensure correct continous operation.



5.9.3 Terminal designations

DIN 42401 stipulates the following terminal designations for electric motors, depending on the motor starting method (see name plate data).

Delta or **star wiring** with 1 cable:

U	V	W

Delta-star wiring with 2 cables:

U 1	V 1	W 1	U 2	V 2	W 2

Delta or **star wiring** with 2 **parallel** cables (as per DIN VDE 0530, Part 8):

U1 – 1	V1 – 1	W1– 1	U1 – 2	V1 – 2	W1– 2

These terminal designations are used throughout the wiring diagrams shown in this operating manual.

5.9.4 Switchgear

Observe the applicable regulations!

Switchgear shall always consist of contactors with integrated motor protection (thermal overcurrent relay), to allow control by pressure switches, float switches, etc., if required.

Switchgear must be in compliance with national regulations (e.g. VDE for Germany) or IEC regulations. In addition, the instructions issued by the switchgear manufacturers must be observed.

The overcurrent relay shall be set as follows ...

- for **d.o.l. starting** to the operating current, at most to rated current I_N.
- for **star-delta starting** to the operating current, at most to rated current x 0.58.

We strongly recommend an integrated ammeter.

5.9.5 Connecting the motor cable in the control box

The motor cable shall be connected to the control box by a trained electrician only!

Observe the markings on the cables when connecting the cables. The motor cable must be connected to the control box by a trained electrician only. In 4-core cables the earth conductor (core colour: green-yellow) is integrated in the cable. In the case of 3-core cables, the earth conductor is separate or included in the 4-core cable. On motors with individual cables, the earth conductor is marked by green–yellow adhesive tape at the end. In both cases, the earth conductor must be connected to the earthing terminal in the control box.

The length of exposed shield should be as short as possible and the shield ends should have contact over a large area. Interruptions of the shield must be EMC-compliant. Observe the EMC instructions given by the equipment manufacturers.

For wiring diagrams please refer to ”Wiring principles 2” in section10.

5.10 Protective equipment

5.10.1 Dry running

Dry-running protection equipment must be installed if the pump is used in wells with excessive water level fluctuations or temporary low yield.
There are semi-automatic and fully automatic systems. For further details please refer to the accessories information supplied with the electrode relay.
The control box UPA Control supplied by KSB features integrated dry-running protection.

5.10.2 Lightning / Overvoltage

We recommend to install lightning protection equipment. Although a lightning protection device cannot offer protection against direct lightning strikes, it will protect the pump unit from atmospheric overvoltage and any lightning strikes nearby. Such devices shall be fitted and connected to the power supply as described in the instructions enclosed with the equipment and in compliance with applicable regulations.

5.10.3 Phase failure

To prevent overloading of the remaining two phases should one phase fail, phase failure protection must be provided for. All motor contactors / control boxes supplied by us have phase failure protection.

5.10.4 Excessive temperature in the motor

If there is a risk that the motor could exceed the permissible temperature as a result of system conditions, e.g. due to deposit build-up on the stator (precipitates out of water, etc.), installation in standing water, dirt/sand deposits in the stator area, major unforeseeable temperature increases in the fluid handled (in cooling circuits, etc.) as well as frequency controlled motors (risk of overheating during operation with low frequencies), our PT 100 temperature monitoring system must be installed.
See section 11, Pt 100 temperature sensor.

5.10.5 Other protection parameters

- Over- / undercurrent
- Earth fault / short circuit
- Current asymmetry
- Over- / undervoltage
- Vibrations

6 Commissioning, start-up / shutdown

6.1 Commissioning / Start-up

CAUTION:
The pump units shall only be switched on when the motor is filled and the unit is fully submerged or flooded!

CAUTION:
As a rule, submersible borehole pumps shall be started up against a closed gate valve!

Due to the water-lubricated plain bearings in the pump and motor, the pump units must only be switched on with filled motor and when fully submerged or flooded. Start-up outside the water, even for short periods, is not permitted.

To prevent pressure surges submersible borehole pumps, as a rule, must be started up against a closed gate valve as follows:

1st step: Close the discharge-side gate valve.
2nd step: Switch on the pump unit and open the gate valve slowly until the pump head and current intensity as shown on the name plate are reached.

Note: If the pump is started up against an empty riser pipe, the gate valve shall not be closed completely, to allow air to escape through the remaining gap into the riser pipe.
It is not necessary to delay the start-up of an gate valve with electric actuator, as the run-up time of the pump is shorter than the dead time of the gate valve.

6.1.1 Commissioning

a) Checking the direction of rotation

CAUTION:
Do not run the pump unit for more than 5 minutes in either direction when checking the direction of rotation!

On single-phase a.c. units (1~) the direction of rotation is set and cannot subsequently be changed.

On three-phase units (3~) the direction of rotation is checked by running the motor in both directions with the gate valve closed. The direction of rotation is changed by interchanging two phases of the power supply cable, resulting in two different pressure gauge readings. The higher reading always indicates the correct direction of rotation. On pumps with free discharge, the correct direction of rotation is indicated by the greater water volume produced, in fountains by the higher jet.

To prevent damage to the motor, make sure that the pump unit does not run in the wrong direction of rotation against the closed gate valve for more than 5 minutes .

b) Commissioning instructions (sand content)

Pumps started up in new boreholes for the first time shall only be operated for approx. 10 minutes with the gate valve only slightly open, also to prevent damage to the well. The water pumped must be checked for any sand content first. If the water contains relatively high amounts of sand, there is a risk for both the pump and the well. The unit must then be operated with the gate valve only partially open (40% of well yield at the most) until the sand content has dropped. Only then shall the gate valve be slowly opened further.

If the sand content does not fall below 50 g/m^3, please contact the well building company or your nearest KSB service centre.

6.1.2 Start-up frequency

To prevent inadmissible heat build-up in the motor, the following max. number of start-ups or minimum standstill periods must be complied with:

Motor size	Max. start-ups per h	Min. standstill period in minutes
DN 100	20	1
UMA 150D	15	2

6.1.3 Pump operation with partially closed gate valve

If the pump is continuously operated against a partially closed gate valve, the flow rate must not fall below Q_{min} (see name plate).

6.1.4 Pump operation with closed gate valve

The pump units shall not be operated against a closed gate valve for more than **5 minutes (max.)**, as the water inside the pump will heat up very quickly and the heat produced will be transferred to the motor, where it may damage the motor winding. Also, bearing damage cannot be ruled out.

6.1.5 Operation with frequency inverter

CAUTION:
Independently of the actual operating frequency, a minimum flow as specified in section 6.1.3 must always be ensured.
The submersible borehole pumps can also be run on a frequency inverter for variable speed operation. Since the electrical losses in the motor are higher when a frequency inverter is used, the pump motor shall have a 5 % power reserve. It is therefore important to consult KSB before retrofitting frequency inverters on pump units already delivered. As submersible motors differ from conventional standardized motors in terms of bearings, moment of inertia, insulation, temperature increase, loss distribution and heat distribution, the following parameters must be observed:

- maximum allowable acceleration time (start ramp)
- maximum allowable deceleration time (stop ramp)
- minimum frequency
- maximum operating frequency
- maximum permissible voltage increase velocity and peak voltages
- control principle of frequency inverter

Maximum allowable acceleration time (start ramp) and deceleration time (stop ramp)

Due to the plain bearings of the submersible motor, operation below the minimum frequency f_{min} is not permitted (operation in mixed lubrication range).

For this reason, the acceleration period from standstill to minimum frequency f_{min} should not exceed 2s. The same applies to the deceleration period.

Minimum frequency

	Minimum frequencies f_{min} (Hz)	
Motor size	Vertical installation	Horizontal installation
DN 100	30	30
UMA 150D	20	30

Maximum operating frequency
Frequency inverter operation above the nominal frequency (50Hz / 60Hz) of the pump unit is not possible, to prevent motor

overload.

Maximum permissible voltage increase velocity and peak voltages

Excessive voltage increase velocities and excessive peak voltages will reduce the service life of the winding insulation. For this reason, the following limits must be adhered to:

- Maximum voltage increase velocity:
  $du/dt \leq 500\ V/\mu s$
- Maximum peak voltages against earth:
  Low-voltage motors ≤ 1 kV: J1 insulation ≤ 600 V
  J2 insulation ≤ 800 V

For motors of pump sizes DN100 and DN150, the limits for J1 insulation apply.

Note: Compliance with these limits can usually be assured by means of a sine filter or $^{du}/_{dt}$ filter.

Control principle of frequency inverter

The control principle of the frequency converter must correspond to linear U/f curve control. If other control principles are employed, such as field-oriented inverters, inverters with DTC or NOF, the manufacturer of the frequency inverter must ensure that the special requirements of submersible motors (very small moment of inertia, electrical data) are taken into account.

6.2 Operating limits

To ensure operational reliability and prevent cavitation, submersible borehole pumps in continuous operation shall only be operated up to the maximum flow rate (Q_{max}) indicated on the name plate. In addition, the maximum permissible power or current intensity must not be exceeded (see name plate). If necessary, power or current intensity must be reduced to the permissible limits by throttling the gate valve accordingly.

For operation with throttled / closed gate valve sections 6.1.3 and 6.1.4 must be observed.

6.3 Shutdown / Storage / Preservation / Returning to service

6.3.1 Shutdown

CAUTION:
Only switch off the pump unit without preparations (emergency stop) if the system has been designed to withstand the resulting pressure surges!

As a rule, the pump shall be switched off with the gate valve closed.

Proceed as follows:

1st step: Close the discharge-side gate valve slowly.
2nd step: Switch off the motor immediately after closing the gate valve.

6.3.2 Storage

The submersible borehole pumps must be stored as follows:
- vertically
- dry
- protected against direct sunlight and heat
- protected against dirt and dust
- protected against freezing.

If the unit cannot be stored in vertical position, it must be stored in such a way that sagging is prevented. The cable must be supported at the point where it comes out of the cable guard and protected against kinking. The cable ends must be protected against the ingress of moisture and dirt. In cases where motors have to be dismantled into components, the individual components shall be dried with warm air and preserved with anti-freeze as described in section 6.3.3.

a) Pump units with pre-filled motors

- Franklin DN 100, UMA 150D

The pump unit has not been in operation yet:
The unit is stored with pre-filled motor. The antifreeze agent in the factory-supplied motor fill protects the motor against corrosion and frost down to t = -15 °C

The pump unit has already been in operation:
The unit is stored with filled motor. The antifreeze agent in the factory-supplied motor fill protects the motor against corrosion and frost.
Antifreeze concentration gradually decreases. Therefore, the antifreeze level must be checked with a spindle. If the anticipated temperature is below the antifreeze value, either increase the antifreeze concentration in the motor accordingly (section 5.2.2) or store the unit in a frost-free location.

b) Draining the motors

- Undo the screwed plugs at the top and at the bottom end of the motor
- Allow the motor to drain
- Flush the motor with water and allow the water to drain
- Dry the motor with warm air
- Preserve the motor as described in section 6.3.3, if required
- Close the motor again, fitting the screwed plugs and the sealing washers.

If the motor has been filled with a water / antifreeze mixture, make sure to follow the safety instructions. The mixture must be disposed of in compliance with local applicable regulations. (See section 5.2.2.)

6.3.3 Preserving UMA motors

CAUTION:
To preserve UMA motors use only the preservatives specified in section 5.2.2!

If the motors have to be preserved, they must be filled with undiluted antifreeze as described in section 5.2.2. These substances also protect the motors against corrosion. Drain the antifreeze from the motor after apr. 1 hour. To prevent damage to the winding insulation, no other preservative shall be used.

6.3.4 Returning to service

Checks prior to re-installation see section 5.7.1.
Proceed as described in section 6.1.1 when returning the unit to service. Also check if the pumping data still matches the name plate data.

7 Servicing and maintenance

7.1 Servicing / inspection

The submersible borehole pumps are generally maintenance-free.
In order to pin-point indications of potential damage at an early stage, regular checks are required. Possible indications of potential damage:

- temperature rise in the fluid pumped
- increased sand content of the fluid pumped
- change in current consumption
- change in discharge head / flow rate
- change in switching frequency
- increase in noise and vibration levels

To make sure that the pump is always ready for instant start-up, the pump unit must be started up approximately every 2 weeks for approx. 5 minutes during prolonged shutdown periods. This will prevent the formation of deposits in the bearing and impeller clearances.
The submersible borehole pumps need not be removed from the well/tank regularly for inspection.

7.2 Repair / Spare parts

For information concerning repair jobs and spare parts please contact your nearest KSB service centre or the KSB factory in charge.

For any queries and repeat orders, particularly when ordering spare parts, please specify the following information (see name plate):

- pump and motor type and size,
- the operating data and
- the works number.

When ordering spare parts please also supply the following data (see enclosed sectional drawings with list of components of pump and motor):

- the sectional drawing number,
- the description and part number,
- the quantity required and
- the mode of dispatch.

8 Flow velocity past the motor v ≥ 0.2 or 0.5 m/s

Depending on the flow rate, a flow is produced along the motor with a certain velocity, which depends on:

- outside motor diameter
- inside well or shroud diameter

The condition v ≥ 0.2 or 0.5 m/s is met if the actual inside well or shroud diameter is lower than or equal to the value given for the inside well or shroud diameter (see table below) at the relevant design flow rate.

Q (m^3/h)	v (m/s)	UMA 150D
15	≥ **0.2**	≤ **215**
	≥ 0.5	≤ 175
25	≥ **0.2**	≤ **255**
	≥ 0.5	≤ 195
50	≥ **0.2**	≤ **330**
	≥ 0.5	≤ 235
75	≥ **0.2**	≤ **390**
	≥ 0.5	≤ 270
100	≥ **0.2**	≤ **445**
	≥ 0.5	≤ 300
125	≥ **0.2**	≤ **490**
	≥ 0.5	≤ 330
150	≥ **0.2**	≤ **535**
	≥ 0.5	≤ 355
175	≥ **0.2**	≤ **575**
	≥ 0.5	≤ 380
200	≥ **0.2**	≤ **615**
	≥ 0.5	≤ 405
250	≥ **0.2**	≤ **680**
	≥ 0.5	≤ 445
300	≥ **0.2**	≤ **745**
	≥ 0.5	≤ 485
350	≥ **0.2**	**--**
	≥ 0.5	--
400	≥ **0.2**	**--**
	≥ 0.5	--
500	≥ **0.2**	**--**
	≥ 0.5	--
600	≥ **0.2**	**--**
	≥ 0.5	--
800	≥ **0.2**	**--**
	≥ 0.5	--
1000	≥ **0.2**	**--**
	≥ 0.5	--

Example:
Pump unit with UMA 150D motor

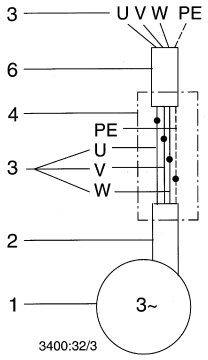
Design flow rate given on name plate	15 m^3/h
Flow velocity given on name plate	0.5 m/s
Maximum permissible inside well or shroud diameter	175 mm

9 Wiring principles 1: Connecting the extension cable in the cable connector

The wiring principles shown are for motors with one 4-core cable and two 3- and 4-core cables. The wiring principles shall also apply by analogy to motors with the corresponding number of three-core and/or single-core cables and externally connected earth conductor.

1) Motors with 1 cable for d.o.l. starting

The motors are wired in delta or star, as shown on the name plate.

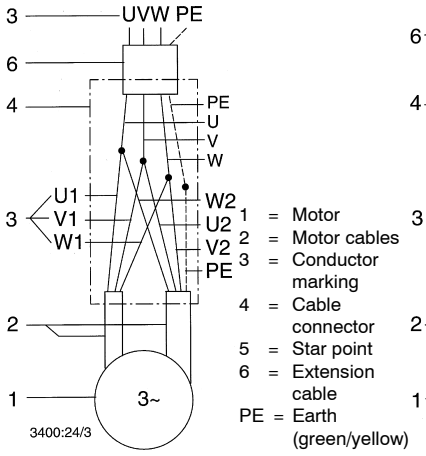


1 = Motor
2 = Motor cable
3 = Conductor marking
4 = Cable connector
6 = Extension cable
PE= Earth (green/yellow)

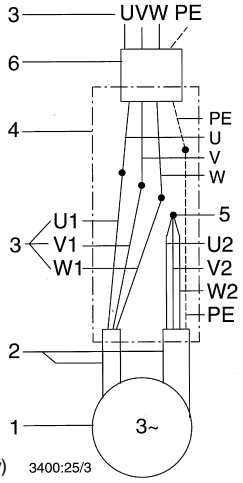
Connecting one extension cable

2) Motors with 2 cables for d.o.l. starting

The motors are wired for both delta and star operation, as shown on the name plate.
Depending on the supply voltage, the motors must be wired in delta or star in the cable connector.
Example: Name plate indicates ”400/690 V”. For a supply voltage of 400 V the motor must be wired in delta configuration. For 690 V it must be star-wired.



Delta configuration



Star configuration

1 = Motor
2 = Motor cables
3 = Conductor marking
4 = Cable connector
5 = Star point
6 = Extension cable
PE = Earth (green/yellow)

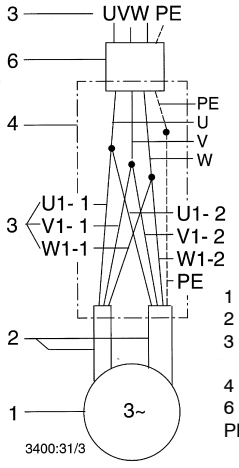
Wiring and connecting of 1 extension cable to 2 motor cables in the cable connector

If the pump unit is ordered ”with extension cable”, the cable connector will be pre-wired in this configuration at the factory. In this case the following applies, as per VDE 0530, Parts 1+8:

- the cable connector is a constituent part of the submersible unit,
- the wiring type shown on the name plate corresponds to the wiring in the cable connector,
- the terminal designations at the conductor ends of the extension cable correspond to the wiring type shown on the name plate.
- **Note:** The details on the name plate do not refer to the wiring in the cable connector if the cable connection has been made by the operator of the submersible unit!

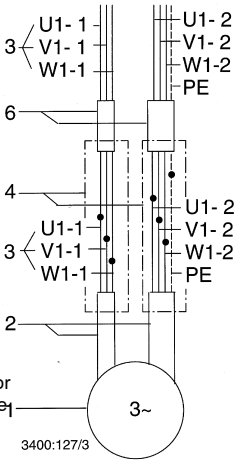
3) Motors with 2 parallel cables for d.o.l. starting

The motors are wired in delta or star, as shown on the name plate, and are fitted with 2 cables in parallel.



1 = Motor
2 = Motor cables
3 = Conductor marking
4 = Cable connector
6 = Extension cable
PE= Earth (green/yellow)

Motor with 2 leads and 1 extension cable

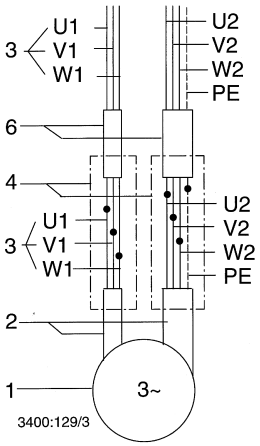


Motor with 2 leads and 2 extension cables

Connecting 1 or 2 extension cables to 2 parallel motor cables

4) Motors with 2 cables for star-delta starting

The motors are wired for both delta and star operation, as shown on the name plate.



1 = Motor
2 = Motor cables
3 = Conductor marking
4 = Cable connector
6 = Extension cables
PE= Earth (green/yellow)

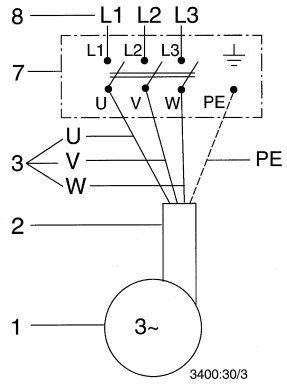
Connecting 2 extension cables to 2 motor cables

10 Wiring principles 2: Connecting the motor cables in the control box

The wiring principles shown are for motors with one 4-core cable and two 3- and 4-core cables. The wiring principles shall also apply by analogy to motors with the corresponding number of three-core and / or single-core cables and externally connected earth conductor.

1) Motors with 1 cable for d.o.l. starting

The motors are wired in delta or star, as shown on the name plate.
The 3 current carrying conductors are designated U, V, W, the earth conductor is marked PE. These motors shall be used for d.o.l. starting only.
Note: For motors with 2 leads and 1 extension cable, the information given on page 20, para. "2) Motors with 2 cables for d.o.l. starting" must be observed.

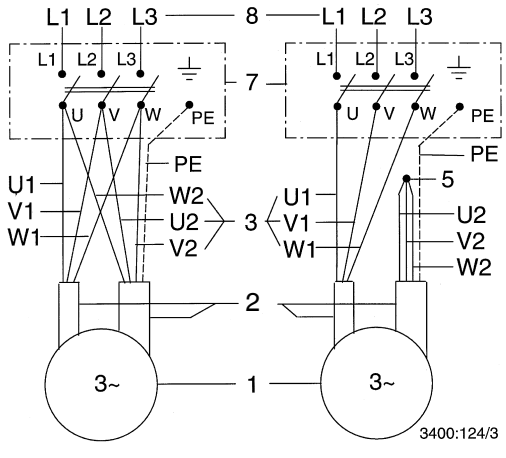


1 = Motor
2 = Motor cable
3 = Conductor marking
7 = Control box
8 = Mains phases
PE= Earth (green/yellow)

Connecting a motor with delta or star configuration and 1 cable for d.o.l. starting

2) Motors with 2 cables for d.o.l. starting

The motors are wired for both delta and star operation, as shown on the name plate. Depending on the supply voltage, the motors must be wired in delta or star in the control box.
Example: Name plate indicates "400/690 V". For a supply voltage of 400 V the motor must be wired in delta configuration. For 690 V it must be star-wired.
The 6 current carrying conductors of the two cables are designated U 1, V1, W1 and U 2, V 2, W 2, the earth conductor is marked PE.

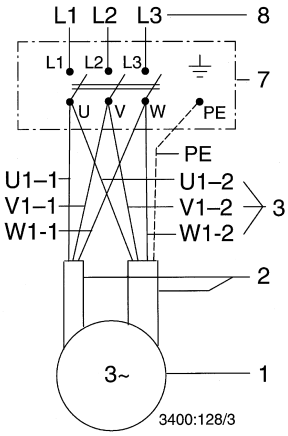


Delta configuration Star configuration

Connecting a motor with delta-star configuration and 2 cables for d.o.l. starting

3) Motors with 2 parallel cables for d.o.l. starting

The motors are wired in delta or star, as shown on the name plate, and are fitted with 2 cables in parallel.
The 6 current carrying conductors of the two parallel cables are designated U1-1, V1-1, W1-1 and U1-2, V1-2, W1-2, the earth conductor is marked PE. These motors shall be used for d.o.l. starting only.

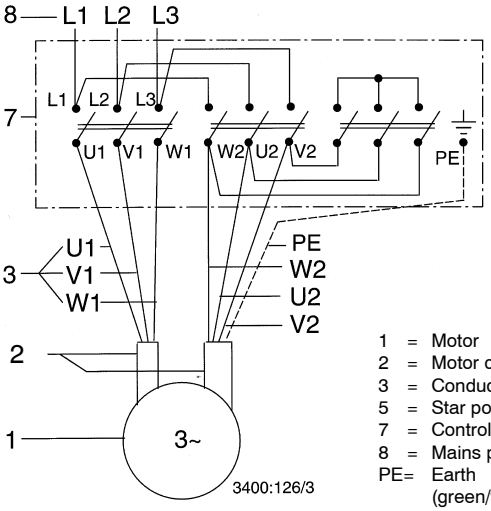


1 = Motor
2 = Motor cables
3 = Conductor marking
7 = Control box
8 = Mains phases
PE= Earth (green/yellow)

Connecting a motor with delta or star configuration and 2 parallel cables for d.o.l. starting

4) Motors with 2 cables for star-delta starting

The motors are wired for both delta and star operation, as shown on the name plate.
The 6 current carrying conductors of the two cables are designated U 1, V1, W1 and U 2, V 2, W 2, the earth conductor is marked PE.

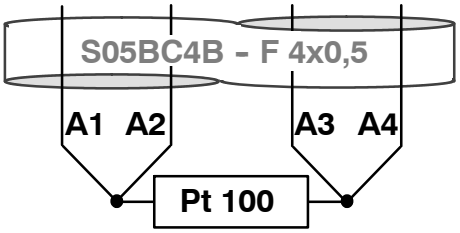


1 = Motor
2 = Motor cables
3 = Conductor marking
5 = Star point
7 = Control box
8 = Mains phases
PE= Earth (green/yellow)

Connecting a motor with delta-star configuration and 2 cables for star-delta starting

11 Pt 100 temperature sensor (optional)

Temperature sensor installed in the motor on option; for measuring the temperature of the motor's water fill.
The sensor is equipped with a shielded 10 metre power cable S05BC4B – F 4 x 0.5 mm^2 as a standard feature.



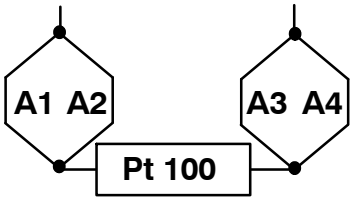
A1 = **BLACK** core
A2 = **BLACK** or **GREY** core
A3 = **BROWN** core
A4 = **BLUE** core

Only one Pt100 temperature sensor is required for protecting the submersible motor.
For analysing the measured signal, a separate analysing device (e.g. accessory "display / control unit for temperature monitoring", ident. No. 90 064 446) is required.

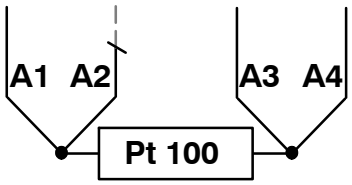
Connection

The sensor can be connected by 2-, 3- or 4-wire system.
(For 3-wire configuration, one of the two black cores must be cut off at the cable end.)

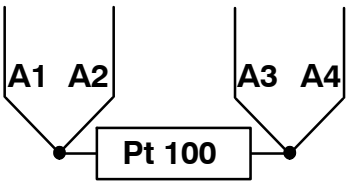
2-wire system



3-wire system



4-wire system



The voltage at the Pt 100 measuring sensor must not exceed 6V. (U_{max} < 6V)

Checking

a) Core-to-core resistance (measure with d.c. voltage U < 6V)
If the temperature sensor is intact, resistances between the individual cores shall be as follows:
A1 to A2 and A3 to A4: 0 Ω to 30 Ω
A1 to A3 and A2 to A4: 100 Ω to 130 Ω

b) Insulation resistance (measure with d.c. voltage U < 100V)
Combine all core ends. Between the core ends and earth (e.g. motor housing), resistance must be higher than 6 MΩ.

Function

Two temperature limits are important for submersible motors.

a) Alert temperature t_{Alert}
If the alert temperature limit t_{Alert} is exceeded, there is a malfunction (e.g. inadmissible contamination / ochre content of motor housing). Corrective action must be initiated.
Setting:
$t_{Alert} = t_{Operation} + (t_{Cutout} - t_{Operation})/2$
$t_{Operation}$ = normal operating temperature after approx. 1.5 hours' operation

b) Cutout temperature t_{Cutout}
If the cutout temperature is reached, the motor must be tripped. It must not be re-started until the malfunction has been remedied.
Setting:
Submersible motors with J1 winding (PVC) t_{Cutout} t = 55°C
Submersible motors with J2 winding (PE) t_{Cutout} t = 75°C
See UMA../.1 or UMA../.2 designation)

Motor type 14D and motors with rated voltages higher than 900V are fitted with J2 winding.

12 Related documents

12.1 List of components with sectional drawing / Spare parts

The pertinent sectional drawings with list of components for pump and motor are always enclosed with the operating manual.

12.2 Models with pump shroud

The requisite assembly / installation instructions are enclosed with this operating manual, as required.

12.3 Pt 100 temperature monitoring system

The necessary details concerning function, operation and checks are enclosed with this operating manual, as required.

12.4 Dry Running Protection

The necessary details concerning function and operation are enclosed with this operating manual, as required.

12.5 Service addresses

The ”Service addresses” booklet (ref. No. 0092.01) is generally enclosed.

EC Declaration of Conformity

Manufacturer: **KSB Aktiengesellschaft**
Johann-Klein-Straße 9
67227 Frankenthal (Germany)

The manufacturer herewith declares that **the product**:

UPA 150C...UPA 350+DN100,DN150
UPA 150C...UPA 350+UMA
UPV+UMA

- is in conformity with the provisions of the following directives as amended from time to time:
  - EC Machinery Directive 2006/42/EC

The manufacturer also declares that

- the following harmonised international standards have been applied:
  - ISO 12100-1/A1, ISO 12100-2/A1,
  - ISO 14121-1,
  - EN 809/A1,
  - EN 60034-1, EN 60034-5/A1

Frankenthal, 29 December 2009

.....

Name

Function

Responsible for compiling the technical documentation
KSB Aktiengesellschaft
Johann-Klein-Straße 9

67227 Frankenthal (Germany)

Subject to technical modification without prior notice.

3400.88 / 3 – 10 12/2010

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